



# **SYSTEM ANALYSIS**

## **SELF ASSESSMENT REPORT**

**Dnipro**

**2017**

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## About the Accreditation Procedure

Self-assessment group

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## Contact Person

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## Seals applied for

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for	Previous accreditation (issuing agency, validity)
Системний аналіз і управління	System analysis and control	Pilot ASIIN Accreditation in the framework of QUAERE Project	<p>Certificate of accreditation Series HD-IV № 0485733 (order of MES of Ukraine of 19.12.16 №1565) Term of certificate till 1 July 2025.</p> <p>Certificate of accreditation Series HD-II № 0492298 (order of MES of Ukraine of 28.07.15 №1709 Л, ) Term of certificate till 1 July 2025.</p>

## Characteristics of the Degree Programme

Name of program	Final degree (original/English translation)	Areas of Specialization	Corresponding level of the EQF <sup>1</sup>	Mode of Study	Double/Joint Degree	Duration	Credit points/unit	Intake rhythm & First time of offer
System analysis and control	Магістр з системного аналізу / M.Sc.	12 Information technology  124 -System analysis	Level 7	Full time	University of Koblenz-Landau (Double degree)	3 Semester	90 ECTS	Annually, from September 1, 2006. New edition - from September 1, 2016

<sup>1</sup> EQF = The European Qualifications Framework for lifelong learning

# Analysis of the Study Programme

## Criterion 1 Eligibility for Program Accreditation

### 1.1. Is the HEI applying for program accreditation a legal entity of Higher Education according to the law of Ukraine?

Yes. The National Mining University is based on a state ownership form and is subordinated to the Ministry of Education and Science of Ukraine.

The University carries out its activities in accordance with the Constitution of Ukraine, the Laws of Ukraine, decrees and orders of the President of Ukraine, the resolutions of the Verkhovna Rada and the Cabinet of Ministers of Ukraine, the Laws of Ukraine "On Education" and "On Higher Education", as well as other legislative acts of the MES of Ukraine, the Statute of the University ([http://www.nmu.org.ua/ua/content/activity/us\\_documents/NMU\\_Statut\\_2017.pdf](http://www.nmu.org.ua/ua/content/activity/us_documents/NMU_Statut_2017.pdf) )

Public Higher Education Institution National Mining University (State Higher Educational Institution „National Mining University“)

Registration Code 02070743

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([http://www.nmu.org.ua/ua/content/study/admission/admission\\_office/admission\\_statute.php](http://www.nmu.org.ua/ua/content/study/admission/admission_office/admission_statute.php))

## Criterion 2 Creation of Programs and Formulation of Qualification Profile

- Relevant stakeholders were involved in the initiation and further development of the objectives and learning outcomes of a degree program.
- The envisaged qualification profile enables students to take up an occupation which corresponds to their qualification and meets the level of the National qualification framework with all its descriptors.
- The objectives and learning outcomes of the programs are described in a competence-oriented and concise way reflecting the state standards for this educational field and professional academic level aimed for. The HEI outlines the distinguishing features of the program in comparison to similar programs.
- The HEI identified a need for graduates with the respective qualification profile and defined the target group of the program (regional, national, international). The learning outcomes are aligned to the needs of the target group.

### Guiding Questions

#### 2.1. How has the intended qualification profile of the degree program been developed (regarding launch of the process, procedure, participants)?

The current educational program of the MSc "System Analysis and Control" is the development of a bachelor's program in the field of "System Analysis", which was introduced at the University in 1999, and the Master's program, introduced in 2006. The educational program was developed in accordance with requirements of the current legislation. Working group consisted of:

program Guarantor:

V.V. Slesarev – PhD, Doctor of Technical Sciences, Full Professor, Head of System Analysis and Control Department in SHEI "NMU"

members of the working group:

I.V. Novitsky – PhD, Doctor of Technical Sciences, Full Professor, Professor of System Analysis and Control Department in SHEI "NMU";

T.A. Zheldak – PhD, Candidate of Technical Sciences, Associate Professor of System Analysis and Control Department in SHEI "NMU";

Us S.A. – PhD, Candidate of Physical and Mathematical Sciences, Professor of System Analysis and Control Department in SHEI "NMU"

The approval procedure for educational programs is determined by the Law of Ukraine on Higher Education, the Resolution of the Cabinet of Ministers of Ukraine No. 1187 from 30.12.2015, Standard "Designing educational process SHEI "NMU", Orders of Chansellor

<http://www.nmu.org.ua/upload/iblock/508/50813ebd0a51508caa2444a95b90ee84.pdf>.

Every developed educational program must be discussed on the methodological council on the specialty, checked for compliance with the educational standard and the current legislation requirements whereafter it must be approved by the Academic Council of the University.

### **2.2. Have all relevant stakeholders been involved?**

The working group did not include students, graduates or employers. Their opinions affected the results in the following manner: by interviewing students and alumni (informal surveys), studying of the employers' needs (examining vacancies and qualification requirements for position applicants through Internet and informal polls). Students took part in the approval of educational programs during their representation at the University Council.

### **2.3. Have the comments from the different stakeholder groups (teachers, students, employers) been taken into consideration?**

Comments were considered which caused the renovation of the educational program. The list of selective disciplines as well as programs of some disciplines were updated.

### **2.4. What processes are in place to reflect on the appropriateness of the qualification profile? How is the program being revised or further developed?**

The program content is revised annually: it is assessed for compliance with modern requirements and needs of society. That assessment is carried out by an examination commission in the specialty. It is formed of academicians from inside and outside the University. Based on analysis of the final certification results (Defence of Masters' Theses), as well as analysis of subject field changes and labor market fluctuations, an annual renovation of the educational program is conducted.

The changes are usually related to its optional part. The compulsory component of the program remains unchanged.

### **2.5. What are the distinguishing features of the program in comparison to similar programs?**

The master's program aims to train specialists capable of solving complex problems in the field of information technologies, systems science and cybernetics. It suggests to use theoretical apparatus of system analysis methods, control, forecasting, decision making under uncertainty and incomplete data, and trains practical skills of analytical work with data of various types. Since the University has a technical focus, more attention is paid to the technological process control as well as economic systems analysis in comparison to similar programs.

### **2.6. Does the intended qualification profile comply with the qualification criteria of the profession?**

There aren't any approved educational standards and qualification requirements for this specialty. Therefore the prospective qualification profile was formed in accordance to labor market requirements.

## 2.7. Who is the target group of the program and do the learning outcomes take the specific needs of the target groups into consideration?

The main target group of the master's degree "system analysis and control" includes students and graduates willing to acquire advanced knowledge and skills of an analyst-researcher and a higher education teacher, having a bachelor's degree (or specialist) in the field of "system analysis" or another specialty in the field of information technology. The program is directed mainly to internal labor market.

### Evidence

- Alumni surveys (appendix 2.1)
- Employer Survey (appendix 2.2, 2.3)
- Website ( <http://sau.nmu.org.ua/en/index.php>)
- Diploma Supplement (appendix 2.4)
- Official documents containing learning objectives (appendix 2.5)

The generalisation of Criterion 2 analysis is presented in Table 1

Table 1

Indicator (Criterion 2)	In the last two years	In the next two years (plan)	Under consideration in the future
Number of Alumni Surveys	2 (not official)	2	1 per year
Number of Employer Surveys	1	2	1 per year
Existence of official, internal evidence about involvement of external stakeholders (employers, municipality, chamber of commerce etc.)	Yes (Diploma Supplement, reports of examination commission)	Yes	Yes
Existence of official body within university/faculty structure with participation of external stakeholders (Yes/No)	yes	yes	yes
Formal participation of students in preparation/review/modification of program (Yes/No)	no	yes	yes

## Criterion 3 Curriculum, structure / work load and mobility

- The curriculum is designed to enable the students to achieve the objectives and intended learning outcomes of the program.
- Each degree program must be divided into courses / modules. It is clear which knowledge, skills and competences students will acquire in each course / module.
- It is evident how each course / module contributes to the achievement of both the qualification level and the overall intended learning outcomes.
- The curriculum is structured in a way to allow students to complete the degree within the regular program duration.
- A credit point system oriented on the amount of work required from students has been devised containing contact hours and time for self-study.
- The structure allows students to define an individual focus and course of study (e.g. field of specialty).
- The curriculum allows students to participate in international mobility (study / internship) without extending the regular study duration.

### Guiding Questions

#### **3.1. Has the program a clear and plausible structure? Do the modules build on one another?**

The degree programme's structure is precise and determinate. It meets the requirements of the current legislation and the university standard (<http://www.nmu.org.ua/upload/iblock/508/50813ebd0a51508caa2444a95b90ee84.pdf>) The program includes compulsory and obligatory optional modules. Curriculum is based on logically connected blocks (modules).

#### **3.2. Is the program divided into different courses that form a sum of learning and teaching?**

The programme is divided into different courses which are formed by the structure of learning and teaching.

#### **3.4. Does the curriculum contain aspects of technical and non-technical competences?**

Yes, the curriculum includes technical and non-technical competencies. In this program, the proportion of disciplines providing non-technical competencies is about 25%. In the first place,

these are competencies providing communicational and organizational skills, a worldview formation. In addition, there are competencies related to the economy, business, language skills.

**3.5. Is it plausible how the program objectives and intended learning outcomes are substantiated in the modules?**

The program objectives and intended learning outcomes are sufficiently substantiated in the modules. They are in the program of disciplines.

**3.6. Is the workload realistic, can the study program be carried out in the regular study duration?**

The students' workload is regulated by the norms of the Ministry of Education and Science of Ukraine and the internal documents of the University. Semester students' workload is 30 credits. All discipline programs are structured in such a way that students can manage all the tasks of current and final controls and successfully pass the final examination. The majority of students finish the program successfully. It confirms that the workload is realistic.

**3.7. Is a credit point system in place considering contact time and time for self-study?**

The study process includes classroom lessons (lectures, seminars, laboratory works) and independent work. The share of self-study work is about 47%-78%, for different courses, and usually it is about 70% and 100% for practice and diploma

**3.8. Do students have the possibility to take elective course? Do the elective courses enable students to develop an individual focus?**

Student's choice is limited by the specializations within the program. Part of the sample rate is 50%. Now there are two specializations defined: 'System Analysis and Control' and 'System Analysis and Complex Systems Modeling'.

**3.9. Are there possibilities for international mobility? Is this supported by the HEI and does the curriculum offer a timeframe where mobility can take place without prolongation of the study time?**

The general procedure for the implementation of academic mobility programs on the territory of Ukraine and abroad is regulated by the Resolution of the Cabinet of Ministers of August 12, 2015 No 579 "On Approval of Regulation on the Procedure for the Reinstitutionalization of the Right to Academic Mobility" and is determined by the Regulation on Academic Mobility of Students, Postgraduates and Teachers of the State Higher Educational Institution "NMU". The University assists students in program selection and preparation of required documents. Being abroad, any student receives full informational support from representatives of his (her) department and the University. Three students have been trained in University West, Trollhättan, Sweden and Delta State University, Cleveland, Mississippi, USA since 2010. Within the framework of this curriculum, a double degree program with the University of Koblenz-Landau is agreed by now. It involves the exchange of students for up to 8 people a year.

## Evidence

- Course / Module descriptions (published) indicating learning objectives, credit points and work load (appendix 3.2, 5.1 )
- Objective-Module matrix, showing how each course contributes to the achievement of the learning objectives (appendix 2.5)
- Curriculum indicating possible fields of specialization and timeframe for mobility (appendix 3.1, 3.3, 3.4)

The generalisation of Criterion 3 analysis is presented in Table 2

Table 2

Indicator (Criterion 3)	In the previous academic year	In the next two academic year years (plan)	Under consideration in the future
Share of elective courses	50 %	50 %	50 %
Number of incoming international students	0	0	2
Number of send students from the program	2	4	2 per year
Existence of formal procedure for recognition of achievements from the period of international mobility (Yes/No)	Yes	Yes	Yes
Existence of procedures for periodical evaluation of workload by students (Yes/No)	No	No	Yes
Existence of procedures for periodical evaluation of workload by academic teachers, authorities etc. (Yes/No)	No	Yes	Yes

## Criterion 4 Admission Requirements

- The admission requirements and procedures are formally defined, transparent and the same for all applicants.
- The admission requirements are defined in a way to enable the students to achieve the intended learning outcomes.
- It must be clear how students can compensate the lack of knowledge or competences without compromising the academic level of the program.
- There are clear rules and procedures for student enrollment defined.
- There are rules in place for recognizing achievements and competences acquired at other (national or international) HEIs.

### Guiding Questions

#### 4.1. Are the admission requirements clearly defined and transparently available?

The admission requirements are clearly defined by “Admission rules” of National mining university. It performed on site of the university.

[http://www.nmu.org.ua/ua/content/study/admission/umovi\\_vstupy/admission\\_rules.php](http://www.nmu.org.ua/ua/content/study/admission/umovi_vstupy/admission_rules.php)

#### 4.2. Are all applicants treated equally? Do all students meeting the criteria have a chance of being admitted? What are the selection criteria?

Admission rules provide equal opportunities for all applicants. To enter the educational master program applicants must have a bachelor's degree and successfully pass examinations in specialty and foreign language. Enrollment is conducted on a competitive basis. There are certain categories of persons, defined by “Admission rules”, to whom special admission requirements are applied. These categories are able to get higher education both ways by state order and at the expense of targeted government grants.

#### 4.3. Do the admission requirements ensure that all applicants have the necessary academic background to be able to study the program successfully?

The minimum level is determined by “Admission rules” and availability of competitive selection for the program

#### 4.4. How can students compensate a lack of competences?

During the study course, students can improve their academic level by attending foreign language courses, participating in non-academic research and programs related to their activities.

#### 4.5. Are there clear and transparent rules of student enrollment?

The rules of student enrollment are determined by “Admission rules” of SHEI “National Mining University”. They are clear and transparent.

#### 4.6. How are academic achievements obtained at other HEI recognized? Is this a fair and transparent procedure? Does it meet the Criteria of the Lisbon Treaty?

There are procedures for achievements recognition received from other universities. These procedures are defined by the Regulations on The Organization of Educational Process and “Admission Rules”, and meet the criteria of the Lisbon Treaty.

#### Evidence

- Rules and regulations dealing with admission of students, providing also information about compensational measures in case of lack of competences
- Rules of student enrollment
- Rules for the recognition of competences obtained at other (national and international) HEI

The generalisation of Criterion 2 analysis is presented in Table 3

Table 3

Indicator (Criterion 4) (For Master Program)	In the previous academic year	In the next two academic year years (plan)	Under consid- eration in the future
Existence of formal procedure to compensate a lack of compe- tences (Yes/No)	No	No	Yes
Actions taken by of Universi- ty/Faculty/Unit as response of the problem of compensation a lack of competences (Yes/No)	No	No	Yes
Existence of procedure to rec- ognize learning outcomes achieved out of university (in- ternships etc.) (Yes/No)	Yes	Yes	Yes

## Criterion 5 Teaching and Learning / Support

- The methods of teaching support the achievement of the intended learning outcomes.
- The teaching and learning approaches take contact time and time for self-study into consideration.
- The didactical methods also include independent academic work and writing.
- The HEI provides advice, guidance and support services (technical and non-technical) that foster the achievement of the intended learning outcomes and the selection of the elective courses.
- The HEI has a conflict management in place to help all concerned parties to conciliate conflicts.

### Guiding Questions

#### **5.1. What kind of teaching methods are being applied? Do the teaching methods support the achievement of the intended learning outcomes?**

The educational process includes theoretical studies (60 ECTS credits) in the form of theoretical study that comprises lectures, workshops, laboratory classes, practical classes and independent work in accordance with the curriculum of disciplines as well as practical training in the specialty (practical training and qualification thesis):

- pre-diploma practical training (4 credits ECTS);
- master's qualification thesis (18 credits ECTS).

#### **5.2. Do the teaching methods also provide time for self-study and independent work?**

Yes. Students get tasks for independent work in accordance with the curriculum of disciplines.

#### **5.3. What kind of general advisory and support services are in place?**

Each teacher has scheduled time for consultations. Group curators also provide necessary advice and support in case of emergency or conflict situations. The University has centers of psychological and legal support for students, business incubators, coworking center, department of international projects, student self-government.

#### **5.4. What kind of course specific support services are being provided?**

For the study of computer related disciplines, students have access to a fully equipped computer class as well as free Wi-Fi access in the classrooms of System Analysis and Control

Department. Students also have the opportunity to use the library of NMU and an electronic repository.

#### **5.5. Do students have the chance to apply for additional support services if need arises?**

Professors of the Department carry out consultations according to the approved schedule. During industrial and pre-diploma practical training, each student has a consultant coordinating his work.

To solve organizational issues, the student can contact with his (her) curator, the administration of the faculty, student self-government.

#### **5.6. Does the HEI provide academic guidance for students with regards to academic development and the choice of specialties?**

Information about educational programs, choice of specialties (Regulations on the list formatting and subjects selection

[http://www.nmu.org.ua/ua/content/activity/us\\_documents/pologenie\\_pro\\_vibir\\_disciplin\\_2017.pdf](http://www.nmu.org.ua/ua/content/activity/us_documents/pologenie_pro_vibir_disciplin_2017.pdf)

and additional opportunities for academic development (courses, additional programs) is posted on the university's website. In addition, teachers of the department and group curators provide appropriate consultations. Students are encouraged to take part in scientific seminars and conferences.

#### **5.7. How does the HEI deal with conflicts? Are there clear rules and procedures for conflict resolution in place?**

Conflicts are resolved on the basis of the provisions of the University Statute. In case of conflict, for its resolution a temporary working group is created. It includes representatives of the faculty, the department, student self-government, trade union organization, legal service and others in need.

#### **5.8. How are conflicts being settled practically?**

The appeal committee is created for consideration of appeal complaints during entrance exams and the session control. In case of conflict temporary working group is created for claim of student.

#### **Evidence**

- Course-module descriptions (appendix 3.2, 5.1, 5.2)
- Other documents providing evidence of the teaching methods applied (appendix 5.3)
- Website providing information on general advisory services / professional advisory services for the respective program (appendix 5.4)

The generalisation of Criterion 5 analysis is presented in Table 4.

Table 4

Indicator (Criterion 5) (For Master Program)	In the previous academic year	In the next two academic year years (plan)	Under consid- eration in the future
Number of students formally involved in research projects on the university/faculty/unit level (non-curriculum activity)	4 ( 30 %)	15	5-10 per year
Share of courses with included project work in curriculum	39 ESTS (43 %)		
Existence of student' scientific association(s) within the struc- ture of universi- ty/faculty/department (Yes/No)	Yes	Yes	Yes

## Criterion 6 Examinations

- Examinations are designed in a way to measure to which extent students have reached the learning outcomes (knowledge, skills and competences) for each individual course.
- Different forms of examinations are being applied to cover all competences aimed for (e.g. oral and writing competences).
- The degree program comprises a final project / thesis which demonstrate that students are able to work on a set task independently and at the level aimed for. The university has processes in place to prevent plagiarism and unethical behavior.
- The examination schedule is made known to relevant stakeholders transparently and in due time.
- The number and distribution of the examinations are organized in a way that both the exam load and preparation times are adequate.
- All students are aware of the details of what is required in order to pass a course / module (pre-examination, assignments etc.) no later than at the start of the course / module.
- Rules for re-sits, cheating, disability compensation measures, illness and other mitigating circumstances etc. are defined.
- All exams are organized in a way which avoids delays to student progression caused by deadlines, exam correction times, re-sits etc.
- All exams are marked using transparent criteria. There are mechanisms in place which ensure that exams marked by different examiners are comparable.

## Guiding Questions

### **6.1. How are examinations being organized? Are they announced in a timely and transparent manner to students? Can students voice out queries if examinations clash or if there is insufficient preparation time?**

Exams are regulated by the schedule of the university's educational process. The semester examination session takes 2 weeks with respect to the schedule, and, according to the curriculum, a student can not have more than 5 exams per semester. Consequently, no less than three days are given to a student for preparation and compilation for one exam. Regarding this particular program, it contains 2 exams in the first semester and 3 exams in the second, so the exam preparation time is quite sufficient.

The exam schedule includes the date, time, and classroom. It is refreshed in advance, and in case of students' dissatisfaction, schedule change is possible within the limits, established by the provisions.

A student may, if there is a valid reason, pass examination ahead of the schedule. In case of non-attendance at the exam, in order to pass it later, the student must present a respectful documented reason of his (her) absence.

In addition, there is a hot line for students' appeals. At the moment, all exams are written.

### **6.2. Is the number of examinations manageable without excessive failure rates?**

The number of exams is independent from the exam failure rates.

### **6.3. Are the examinations designed in a way to appropriately assess the competences achieved by students?**

Questions for control, evaluation criteria are contained in discipline programs. The examination tickets are constructed in accordance with these criteria.

### **6.4. Does the program contain a final thesis that shows that students can work on an academic task independently? Is the thesis of adequate standard, using up-to-date literature?**

Yes, the educational program includes the completion of the thesis. Its structure and components are determined by the requirements for master's theses and related methodological support.

### **6.5. How does the university prevent plagiarism and other kinds of unethical behavior?**

There is no centralized verification of plagiarism. The supervisor of student work is responsible for absence of plagiarism in it.

### **6.6. Is all relevant course information being provided in a transparent and timely manner?**

Yes. Teacher is required to provide such information at the very beginning of the course. The discipline programs are available in the departmental electronic network.

### **6.7. Are there rules for re-sits, cheating and compensational measures for students with disabilities?**

The fraud of students causes for poor evaluation. Rules of re-examination in case of unsat-

isfactory evaluation are determined by the Regulation of the educational process organization. There are no specific compensatory measures for students with disabilities.

**6.8. Does the correction time of cause any delays in student progression?**

The correction time of exam causes no delays in student progression.

**6.9. What kinds of marking criteria are in place? Are they transparent and plausible? Is it secured that all students are treated equally and fairly?**

The assessment criteria are set out in discipline programs and state attestation requirements. Compliance with these criteria ensures equal opportunities for all students.

**6.10. How is it ascertained that examinations and marks are comparable between different lecturers teaching the same subject?**

There is no special control. There is a periodic check of the final knowledge or in the form of chancellors's control.

**Evidence**

- Examination time schedule [http://www.nmu.org.ua/ua/content/student\\_life/students/](http://www.nmu.org.ua/ua/content/student_life/students/)
- Examinations of different courses
- Final Theses
- Policy on plagiarism and unethical academic behavior
- Failure rates of examinations
- Rules for re-sits, cheating and compensational measures for students with disabilities
- Rules providing information on correction time of examinations and final theses
- Marking criteria

The generalisation of Criterion 6 analysis is presented in Table 5

Table 5

Indicator ( <b>Criterion 6</b> )	In the last two academic years	In the next two academic year years (plan)	Under consideration in the future
Existence of formal requirements for creation of examinations schedule (Yes/No)	Yes	Yes	Yes
Existence of formal procedures for dealing with student' complains in the aspect of examination (Yes/No)	Yes	Yes	Yes
Evaluation of courses/modules/subjects by students, number of surveys (others method).	0	1 per semester	1 per semester
Existence of anti-plagiarism procedure (Yes/No)	No	Yes	yes

## Criterion 7 Human Resources

- The composition, scientific orientation and qualification (academic and professional) of the teaching and administrative staff are adequate for successful program implementation.
- There are sufficient staff members for fulfilling all teaching obligations, providing assistance and advice to students and to carry out all administrative tasks for the full duration of accreditation.
- There must be rules to safeguard the qualification of external / international teachers or practitioners (outside of the HEI).
- There are procedures in place how teachers harmonize content of their courses and avoid overlap.

### Guiding Questions

#### **7.1. Do the staff members have adequate proficiency / academic credentials to teach the courses in an appropriate professional and academic standard?**

All staff members, involved in the implementation of the educational program, have a sufficient level of qualification. It is confirmed by the certificates of advanced trainings, corresponding to the license conditions and conditions of competitive selection. The decision whether teachers' qualification level corresponds to disciplines, planned for him, is made on the department level. Information about the faculty and external lecturers is presented at the university's website (<http://sau.nmu.org.ua/en/kadry/teachers.php>).

#### **7.2. Is there sufficient staff (academic, technical, administrative) available to successfully implement the program without structural overload (including advisory services)?**

Yes, the pedagogical staff is sufficient for the introduction of an educational program, for lectures, seminars, practical and laboratory classes delivery, for organization of independent work of students. The workload of the staff is defined by the current legislation and regulated by the University. Existing norms of the workload are not exceeded.

#### **7.3. Are any staff members close to pension age? What are the plans for the succession?**

At the moment, the co-workers of the retirement age are involved in the educational process. The department is fully capable of correspondent substitutions if necessary. As a rule, for lecturers of retirement age, practical and laboratory classes are conducted by younger staff, who thus acquire the appropriate skills and abilities to be prepared to teach the disciplines in the future. The existing postgraduate and doctoral studies at the university make it possible to form the necessary personnel reserve.

#### 7.4. How are external lecturers being selected and what kind of contribution do they provide for the implementation of the program?

Admission of external lecturers is carried out on the basis of the Regulations on competitive selection procedure for filling the vacant positions of scientific and pedagogical workers in the State Higher Educational Institution "National Mining University" and signing contracts with them. It establishes the relevant admission criteria (the Regulations is available on the university's website)

[http://www.nmu.org.ua/ua/content/activity/us\\_documents/polojena\\_pro\\_obr\\_prinatanarobotu.pdf](http://www.nmu.org.ua/ua/content/activity/us_documents/polojena_pro_obr_prinatanarobotu.pdf)).

At the moment, external staff are not involved in the implementation of the program.

**7.5. Is there any kind of procedure in place to harmonize the content of courses / modules?** The contents of the modules are periodically discussed at the meetings of the methodical commission, and if necessary, the update is made.

#### 7.6. Is overlap between different courses being avoided?

Course programs, approved by the methodical commission, are considered at the department meetings. This procedure, which the guarantor is responsible for, excludes any duplications.

#### Evidence

- Staff handbook presenting short CVs of all staff members including external lecturers (appendix 7.1, 7.2)
- Rules showing how external lecturers are selected (meeting the necessary academic standard)
- Overview of teaching obligations of staff members and teaching that is required to implement the program
- Figures on student staff ratio

The generalisation of Criterion 7 analysis is presented in Table 6

Table 6

Indicator (Criterion 7)	In the last two academic years	In the next two academic year years (plan)	Under consideration in the future
Number of students per one staff member	5		
Number of external lecturers participate in the program	0		
Existence of procedure to evaluate staff competences for education (Yes/No)	Yes	Yes	Yes
Existence of formal requirements for admission of new members of staff (Yes/No)	Yes	Yes	Yes
Number of pedagogically trained staff.	5	According to the schedule of the department	According to the schedule of the department
Existence of procedure for periodical reviewing the content of courses, modules etc. (Yes/No)	No	Yes	Yes

## Criterion 8 Material Resources

- The infrastructure and equipment are appropriate in quantity and quality to implement the degree program successfully.
- Teachers and students have access to relevant up-to-date publications particularly in English as well as peer review journals
- The HEI makes available all necessary resources (e.g. hardcopies, electronic editions or e-journals etc.) to the students to enable them to successfully pass the courses / modules.

### Guiding Questions

#### **8.1. Is the infrastructure and technical equipment appropriate to achieve the academic and professional learning outcomes?**

The educational process of masters' training is carried out at the educational and laboratory areas of the university, which are included in the schedule of occupations in the specialty. The audit fund fully provides lectures and practical exercises using computer technology in all disciplines. All the premises meet the requirements of sanitary and building standards, as well as regulatory documents, governing the conduct of educational activities.

The educational process on the department is supported by two computer laboratories, multimedia projector classroom. However, the update of the computer fund is still required.

#### **8.2. Is the general academic infrastructure (access to relevant up-to-date literature, computer labs, etc.) available in sufficient quality and quantity?**

State Higher Education Institution "NMU" "NSU" has on the balance of 48 buildings and structures with a total area of 125 567.4 m<sup>2</sup>. For the educational process, 71 392.5 square meters of area are used, which has 195 auditoriums; laboratories and computer (display) classes; 1 500 m<sup>2</sup> are allocated for research activities; for housing - 46 441 m<sup>2</sup>. Statements about the auditorium are provided in a supplement 7.1.

The University Library is located in the main building of the University and occupies an area of 2054 m<sup>2</sup>. The book fund has 842 thousand copies and has a book depository with an area of 1054 m<sup>2</sup>, 6 reading rooms for 250 seats, incl. methodical cabinet for students of the Institute of Economics for 30 seats and a room for teachers for 30 seats, subscriptions to technical and artistic literature. The library is computerized, connected to the Internet. The University Library is the only one among the libraries of higher education institutions in the region, which is certified by the first category. An annual grant exceeds one million books. Now the library continues to create electronic and retrospective directories. Educational literature is available at the university library. The library fund fully provides the disciplines of the curriculum of masters. In addition, all necessary materials are available in the internal electronic network of the department, which con-

tains an electronic repository about 4 gb, as well as on the pages of disciplines in moodle system. Teachers of the department and students have access to the global Internet network through the central server of the university and the classes of the PC, which makes it possible to use electronic variants of methodological provision of disciplines of the curriculum.

The student's provision of the hostel is 100%.

**8.3. Is there an adequate learning environment (learning space, rooms for group work, etc) in place?**

The University has a sufficient classroom fund for classroom trainings, providing qualitative education in all disciplines of the curriculum.

**Evidence**

- List of course relevant equipment (appendix 8.1, 8.2)
- Course / Module descriptions

## **Criterion 9 Financial Resources**

- The HEI has appropriate financial resources for the full duration of the accreditation to successfully implement the degree program.

**Guiding Questions**

**9.1. Are the financial resources sufficient to implement the program successfully?**

State funding does not cover all University expenditures, so some part of it is covered by the earned funds.

**9.2. Are the financial resources secured for the entire accreditation period?**

At the moment of educational program implementation there is no full guaranteed state funding to cover it during all the period. Financing is carried out within a budget year (from January 1 up to December 31).

**Evidence**

- Overview of financial budget and prospective financial recourses

## Criterion 10 Quality Management

- The HEI has official rules in place defining all quality assurance procedures and responsibilities.
- The HEI applies methods suitable for the purpose, identifying weaknesses and improving the degree program.
- For each program quality assurance procedures including different stakeholder groups (e.g. students, lecturers, graduates/alumni, and potential employers) are being carried out regularly aiming at continuous improvement.
- The outcomes are brought to the attention of relevant stakeholders.
- The feedback loops are plausible and the measures derived are made known to anyone involved.

### Guiding Questions

#### 10.1. Does the HEI have a quality management policy in place?

Quality control procedures are determined at the level of higher educational institutions, at the level of the faculty and departments there are no such procedures.

#### 10.2. What kind of quality assurance procedures does the HEI have in place? Do the procedures take different stakeholder groups like students, alumni, teachers, professional partners, employers, and graduates on-board?

Quality assurance procedures are determined by the Strategy and Program Development of the University until 2025, the policy of quality assurance of the SHEI "NMU". These documents, posted on the University website, include: quality assurance of educational programs, quality assurance in teaching and assessment, quality assurance of teaching results, ensuring the quality of student work (master's and graduate theses, as well as any other types of tasks performed by students, such as essays, articles, etc.). All stakeholders are involved in formal processes of quality assurance at the University, however for some of them the involvement is not formal.

#### 10.3. Are the results being analyzed systematically and made available to relevant stakeholder groups?

The results of implementing the policy of education quality assurance are analyzed at the meeting of the Academic Council of the University, meetings of the methodical council and the academic council of the faculty. Results are partly available to employers and other stakeholders.

#### 10.4. What kinds of feedback mechanisms are in place to use the data for critical self-reflection?

Students form full-fledged parts in Academic Councils of the Faculty and the University, participate in the consideration of all issues, make their proposals, which are taken into account during organization of educational and scientific work

The Center for Sociological Audit conducts annual surveys of students of the entire university. These surveys cover various aspects in organization of academic work, scientific work, etc., which are taken into account while implementing educational programs. However, these polls cover only a part of university students.

The teacher independently (if desired) may organize the collection of reviews about his discipline. After that, he can analyze the results and take them into account.

#### **10.5. What kind of concrete measures have been derived from the evaluation results?**

As a result of the curriculum revision some adjustments were made, regarding volume of disciplines, practical and laboratory work.

#### **Possible Evidence**

- Quality assurance policy (appendix 11)
- Quality assurance tools like questionnaires for course evaluation, alumni, graduates, professional partners, employers (appendix 2.1, 2.2, 5.3)
- Results of evaluation procedures
- Documentation about measures derived from quality assurance data

The generalisation of Criterion 10 analysis is presented in Table 7.

Table 7

Indicator (Criterion 10)	In the current academic year	In the next two academic year years (plan)	Under consideration in the future
Existence of Quality Assurance System at the University/Faculty/Department level (Yes/No)	Yes/no/no	yes	yes
Existence of Quality Policy Statement at the University/Faculty/Department level (Yes/No)	Yes/no/no	yes	yes
Existence of strategy/strategical plan/master plan etc. for the university/faculty/department etc. (Yes/No)	Yes/no/no	yes	yes

## Criterion 11 Transparency and Documentation

- The HEI developed rules and regulations defining all rights and duties of the HEI and the students. These rules are available to all relevant stakeholders.
- Program relevant information (including its distinctive features and organizational peculiarities) is available to relevant stakeholders
- The HEI provides course / module descriptions containing information about the objectives and intended learning outcomes of the course / module, the literature (textbooks, manuals, monographs, peer-review journals etc.), the teaching method and the examination assessing the achievement of the intended learning outcome.

### Guiding Questions

**11.1. Are all kinds of relevant rules and regulations defined covering all aspects of the student life cycle? Are they published and transparently available to all relevant stakeholders?**

The rules covering all aspects of student life are defined by a series of university documents that are published on the university's website. Among them there are the Regulations on the organization of the educational process, the Regulations on the Student Scholarly Society, the Regulations on student self-government and others.

**11.2. Is all program relevant information being made available to interested stakeholders?**

Information on the program is published on the university's website and is publicly available

**11.3. Do the course / module descriptions contain all relevant information about course objectives, learning outcomes, teaching methods, required literature, examinations etc.?**

All necessary information (the course purpose, learning outcomes, teaching methods, literature, exams) are essential components of discipline programs. These programs are formed according to the approved university standard.

### Evidence

- Rules and regulations covering all aspects of the students life cycle (appendix 5.4, 11)
- Course / module descriptions(appendix 5.1, 5.2)

## APPENDIXES

## APPENDIX 1.1

## Certificate of Accreditation



## APPENDIX 2.1

### Query for Graduates

First name (optional)\_\_\_\_\_

Contact phone (optional)\_\_\_\_\_

The year of finishing the educational program\_\_\_\_\_

What was your average grade for diploma?

1. Do you work in the specialty?

Yes

No

2. If no, for whatever reason?

3. How much time did you spend to find a job?

1 - 2 months

3 - 6 months

More than 6 months

4. Is there a sufficient level of salary for system analysts in the labor market?

Yes

No

3. Are you satisfied with the education you have gotten?

Yes

No

4. Did you need a retraining or an additional training to get a job?

5. What knowledge, competences do you consider necessary to be added to the educational program 124-system analysis?

6. What disciplines do you consider excessive?

#### **Evaluation of the educational process**

1. Were the order of studying disciplines, the plan and schedule of the educational process, logical and consistent?

Yes

No.....I can not say

2. Was the qualification of the lecturers involved in the implementation of the educational program 124 – system analysis sufficient?

Yes

No.....I can not evaluate

3. Were there enough time to learn the components of the educational program?

Yes

No (If no – please explain)

4. Evaluate the complexity of the training within this educational program

Very easy

Light

Average

Hard

## APPENDIX 2.2

### Query for Employers

Full name of the organization, institution, other interested part

---

Contact person

Phone

E-mail address

#### 1. Evaluation of the quality of graduates training

1.1. Do you have in your organization specialists (employees), prepared by the educational program 124- system analysis?

Yes

No

1.2. How can you rate the quality of education of these specialists?

High

Good enough

Low

Extremely low

1.3. Was there a need for additional specialist training? In what amount?

Yes

No

Some additional training for specific tasks of the organization

Special courses for additional education

1.4. Do you plan to involve specialists trained within the educational program 124- system analysis in the future?

Yes

No

#### 2. Evaluation of the educational program

2.1. Do you think that the training of specialists within the educational program 124 – system analysis meets the requirements of society?

Yes

No

2.2. Do you consider training specialists within the educational program 124 – system analysis relevant and necessary?

Yes

No

2.3. Does the educational program 124 – system analysis meet the requirements of expert analysts?

Yes

No

2.4. Does the educational program 124 – system analysis have sufficient competencies to train such specialists?

Yes

No

### **Open questions**

2.5. What competencies should be added to the educational program 124?

2.6. What additional knowledge (skills) should be provided by the educational program 124?

2.7. What competencies are excessive?

2.8. What knowledge (abilities) is (are) excessive for specialists of this profile?

2.9. What disciplines should we add to the educational program?

2.10. What disciplines should we remove?

### **General evaluation of the educational program**

Excellent

Fine

Satisfactorily

Unsatisfactorily

## APPENDIX 2.3

### The Analysis of the Survey of Employers

**Collection and systematization of information.** As test subjects, job market vacancies in the field of computer information technology and system analysis were selected, namely: system analyst, project manager, information resource specialist (IRSP), information systems specialist (ISSP).

Identification of competencies presented by employers to graduates of higher educational institutions or applicants for a certain position was carried out using questionnaires (see questionnaire).

Over the course of one quarter of this year, two hundreds of employers' letters were examined from different employer websites indicating the knowledge, skills and abilities that an applicant for one of the above positions should possess. Each profession in the sample is represented by fifty requests. All collected information is structured as a MS Access database "Employers' Requirements". In total, the database has 1300 entries.

Recall that the requirements of employers mean their expectations about the competence of employees of a particular profession and a specific job level. A modern professional education system should have clear concepts about what kinds of professional activities they are preparing for, and not just prepare unified workers who have competencies, some of which may have become obsolete. In this regard, the analysis of the needs for knowledge and skills should be carried out on the maximum possible sample of enterprises, focused on development, since it is the only way to create benchmarks for the best examples of professional activity. That is why when collecting data, information was also taken into account of which area of the national economy (industry, production, science, knowledge) belongs to the employer. The list of areas of the national economy that are included in the database is shown in Table 1.

Table 1

Areas of the national economy included in the database "Employers' requirements"

Area_code	Area_name	Area_code	Area_name
1	Housing and utilities	21	Media
2	Non-productive types of consumer services	22	Analytics
3	Health protection, physical culture and social security	23	Power engineering
4	Education	24	Fuel industry
5	Finance, credit, insurance, pensions	25	Ferrous metallurgy
6	Culture and art	26	Non-ferrous metallurgy
7	Science and scientific service	27	Mechanical engineering and metal working
8	Management	28	Chemical and petrochemical industry
9	Party and public associations	29	Forestry, woodworking and pulp and paper industry
10	Geological exploration	30	Building materials industry
11	Trade	31	Industry of building constructions and details
12	Building	32	Glass and porcelain-faience industry
13	Transport and logistic	33	Light industry
		34	Food Industry
		35	Microbiological industry

14 Service Companies	36 Flour-and-cereals and mixed fodder industry
15 Telecommunications	37 Medical industry (production of medical equipment and instruments)
16 IT	38 Pharmaceuticals
17 Design	39 Other industries
18 Advertising	
19 Security	
20 Tourism	

**Results of analysis of collected information.** The presentation of the material of this item will be carried out according to the following scheme: 1 - setting of the specific analysis task (goal), 2 - preliminary data processing, 3 - input data structure for solving the task, 4 - interpretation of the results, conclusions and recommendations.

**Task 1.** In what area of the national economy, science or industry are the most popular professions?

In the database, a query of the fields is formed: "respondent's code", "industry code", "profession".

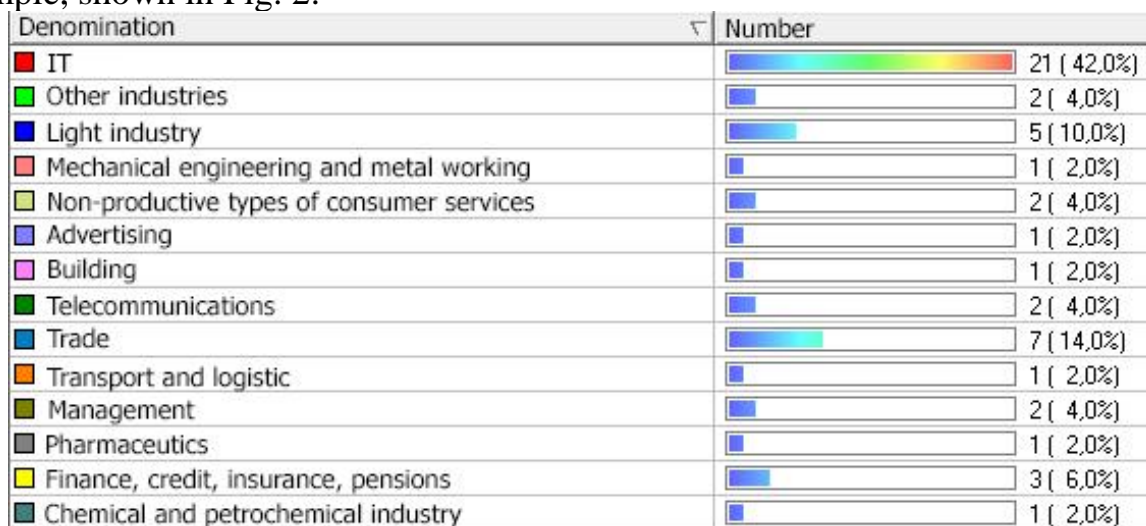
With the help of the Deductor 5.2 platform, a cross-tabulation with fact aggregation is constructed, which displays the number of respondents in a particular industry who expressed their opinion about the competence of specialists in the relevant profession (Table 2).

Table 2

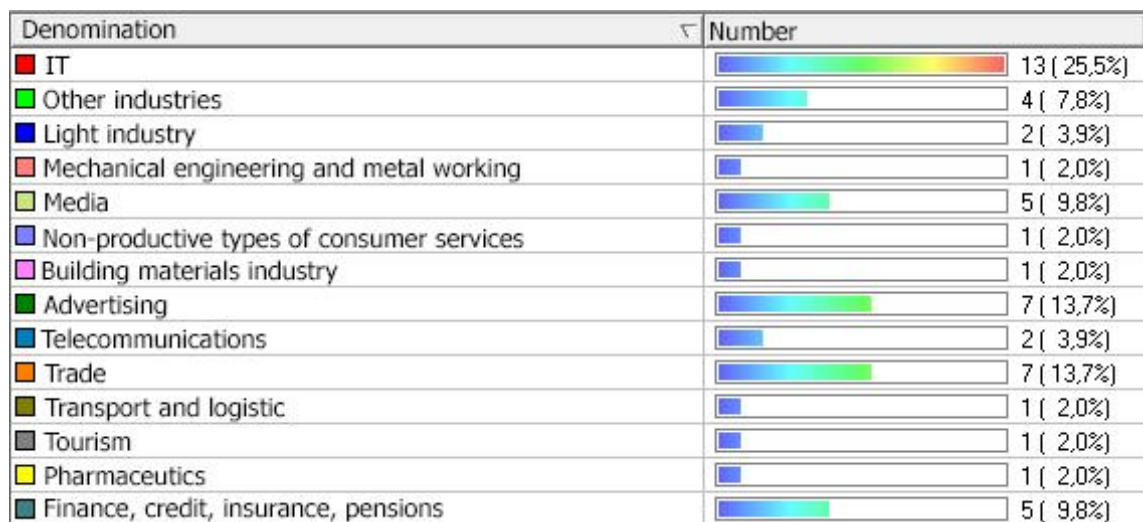
Cross-table "Profession - Branch of the National Economy"

Profession	11	12	13	15	16	18	2	20	21	24	27	28	3	30	33	38	39	5	8
	esp	esp	espo	espo	espo	esp	esp	esp	espo	espo	esp	esp	esp	espo	espo	esp	esp	esp	esp
Project manager in the IT field	7		1	2	13	7	1	1	4		1			1	2	1	4	5	
System analyst	7	1	1	2	21	1	2				1	1			5	1	2	3	2
IR specialist	9			1	9	10	8	1	1		4		2		1		1	1	1
IS specialist	7		1	4	13	2	6		1	3					1	2	2	8	1

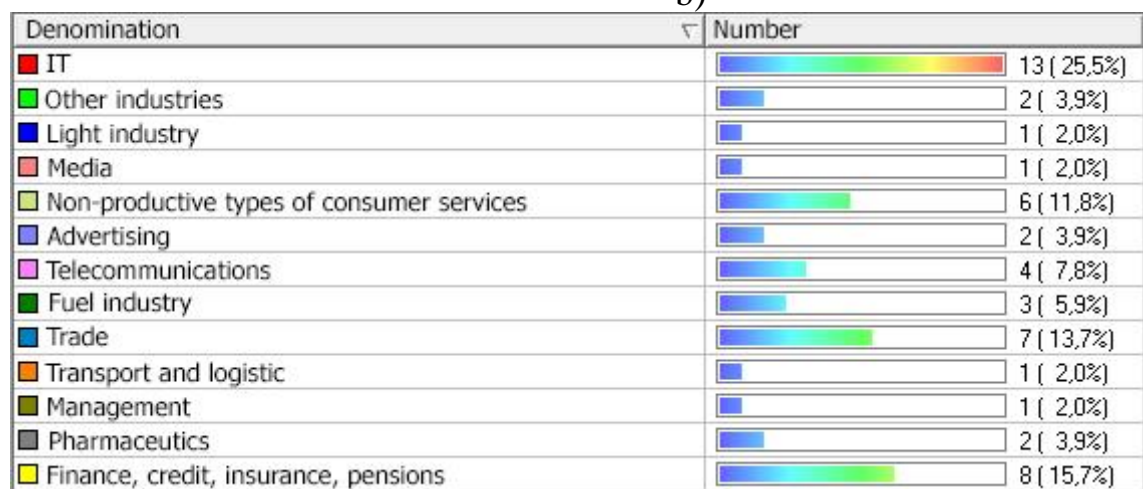
The received information can be visualized in the form of diagrams, for example, shown in Fig. 2.



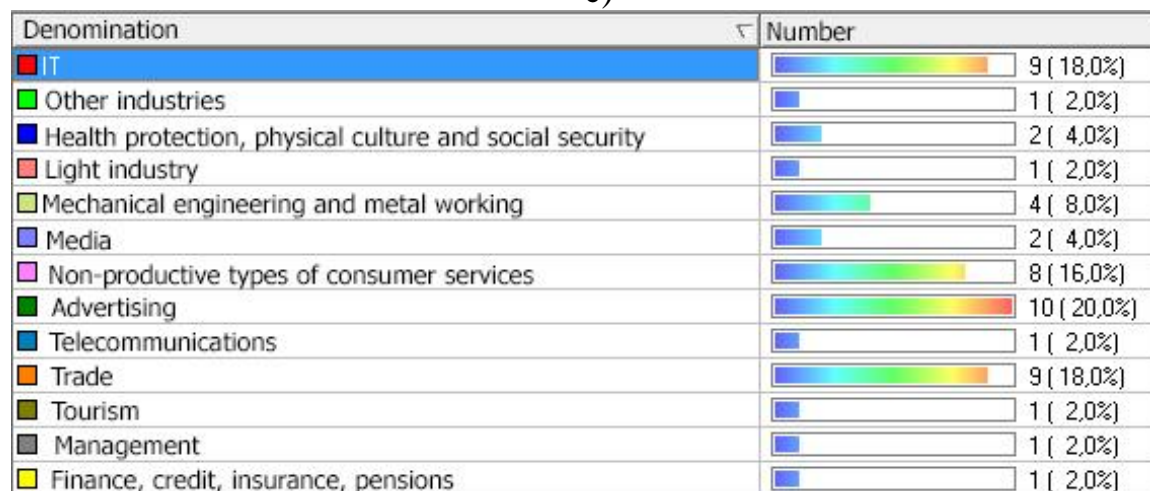
a)



b)



c)



d)

Fig. 2. Interest in specialists: a) - system analyst; b) Project Manager; c) IT specialist; d) IS specialist

So, 1) the specialists of all four professions in question are most in demand in IT and trade, and if in the first area the need for system analysts significantly exceeds the others, in the second - all professions are fairly widespread and almost evenly; taking into account the latter, it is possible to make recommendations on the availa-

bility in the educational programs of specialists in these professions of selected disciplines, for example, with regard to both audit and marketing; 2) specialists in information resources are equally in demand in such areas as IT, trade, advertising, non-productive types of consumer services; 3) specialists in information systems, except IT and trade, are also involved in the areas of finance and credit, insurance, telecommunications; 4) the profession of the IT project manager is also characteristic for the advertising, finance, media and other (not represented in the database) industries.

**Task 2.** Search for sets of the most common competencies for each particular profession. For the profession System Analyst 25 popular sets of competencies, for an IS specialist and IT project manager - 25 for each. Some of these sets of competencies for system analysts are shown in Fig. 3.

Sets: 25 of 39		Filter: Minimum support = 15.65		
№	Number of set	ab. Elements	Support	
			Number	%
1	37	Analytic skills	8	16.00
		Attention to details		
		Responsibility		
2	36	Analytic skills	8	16.00
		Attention to details		
		Knowledge of Excel		
3	32	Knowledge of Excel	10	20.00
		Ability to work with large volumes of information		
4	27	Attention to details	8	16.00
		Confident user of MS Office, Microsoft Project		
5	26	Attention to details	9	18.00
		Responsibility		
6	25	Attention to details	9	18.00
		Knowledge of Excel		
7	24	Analytic skills	10	20.00
		Level of English - Upper-Intermediate		
8	23	Analytic skills	8	16.00
		Ability to work with large volumes of information		

Fig. 3. The most popular sets of competences based on the results constructing associative rules for the profession System Analyst

Using the discovered sets of competences, rule trees are built - two-level trees by antecedent or by consequent. When constructing the rules tree by antecedent, the nodes (with the antecedent) are on the first (upper) level, and the nodes with the consequent at the second level. The second variant of the rules tree is a tree constructed by the consequent. Here at the first level are the nodes with the consequent. As an example, in Fig. 4 shows the rules tree, built on the basis of the most popular sets of competences for the profession of Information Systems Specialist. Here - 5 rules. Their details are shown in Fig. 5, and the interpretation can be:

- if the employer requires analytic skills from the candidates for the post of IS specialist, then in 25.5% of cases together with this will require attention to detail;

Rules: 5 of 5		Filter: Without filtering				
№	Rule number	Antecedent	Consequent	Support		Confidence
				Number	%	
1	1	Attention to details	Analytic skills	6	11.76	85.71
2	2	Deep knowledge of Oracle D	Level of English - Upper-Int	6	11.76	60.00
3	3	Level of English - Upper-Inte	Level of English - Upper-Int	7	13.73	87.50
4	4	Confident user of MS Office,	Confident user of PC	9	17.65	64.29
5	5	Confident user of PC	Confident user of MS Office	9	17.65	90.00

Fig. 4. Rules for compiling the sets of competencies of an IS specialist

- if the employer has the opinion that the level of English at the pre-applicant for the position of an IP specialist should be Upper-Intermediate, then in 12% with it the applicant must have a deep knowledge of Oracle DBMS, SQL programming languages, PL / SQL, etc.

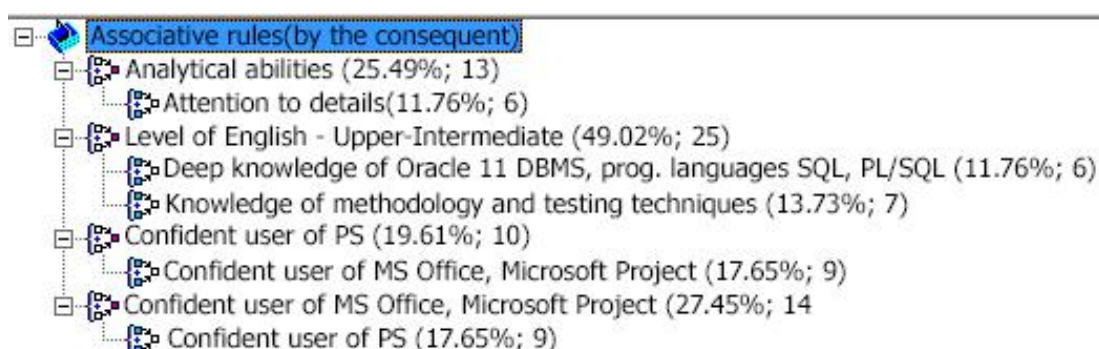


Fig. 5. Details of the rules tree on compiling sets of competences IS Specialist

In Fig. 6 presents details of some rules regarding the composition of the competencies of the system analyst for the requirements of the employer.

Denomination	Number
IT	13 ( 25,5%)
Other industries	4 ( 7,8%)
Light industry	2 ( 3,9%)
Mechanical engineering and metal working	1 ( 2,0%)
Media	5 ( 9,8%)
Non-productive types of consumer services	1 ( 2,0%)
Building materials industry	1 ( 2,0%)
Advertising	7 ( 13,7%)
Telecommunications	2 ( 3,9%)
Trade	7 ( 13,7%)
Transport and logistic	1 ( 2,0%)
Tourism	1 ( 2,0%)
Pharmaceutics	1 ( 2,0%)
Finance, credit, insurance, pensions	5 ( 9,8%)

Fig. 6. Detailing the rules for compiling sets of competences

In general, with the above parameters, rules such as " antecedent - consequent " are constructed: for the system analyst - 20 for the IT project manager - 6. Using the rules tree, analyzing the composition of the most popular sets of competences for all the professions in question, you can trace the interrelation between these professions.

In Table. 3 shows the general competencies for candidates for the post of system analyst, information systems specialist, information resource specialist and IT project manager, who were able to find out by analyzing the information gathered about the requirements of employers. Such summary data demonstrate the similarity of the above occupations and can be useful in the development or comparison of educational training programs.

With the help of Data Mining methods, it is possible to identify those competencies that employers think are inherent only in one profession. And consequently, by eliminating those knowledge and skills that have support, less than a certain threshold, it is possible to form a list of competencies that will determine the specificity of a particular profession.

Table 3

General Competencies for Professions System Analyst, IS Specialist, IR Specialist, IT Project Manager

Type of competence	Name of competence	Professions
Professional production (PP)	The level of English - Upper-Intermediate Ability to create and work with test documentation Ability to work with 1C, Confident user of PC, Confident user of MS Office, Microsoft Project Subject area, Understanding the principles of SEO Understanding the basic principles of software development The Basics of HTML / PHP / MySQL / JavaScript Fundamentals of Management, Knowledge of CRM system, Knowledge of Excel Correct oral and written language Deep knowledge of e-commerce systems Fundamentals of SQL, Web programming	Information Systems Specialist (IS_S)  Information Resource Specialist (IR_S)  System Analyst (SA)  IT Project Manager (PM)
Personal	Purposefulness, multitasking, stress tolerance, decency Ability to set goals and achieve them Ability to work with large volumes of information diligence, self-discipline, Responsibility, initiative, accuracy, Focus on the result, Creative approach to finding solutions Attention to details, Ability to learn quickly Analytical skills, Active life position	
Social	High level of communication skills	
Managerial	Ability to organize the work of the team and work in it	
Professional production	Understanding the structure of web development The skills of working with project documentation (BRD / FSD / UMD / MRD) The skills of working with Redmine / JIRA Fundamentals of QA (testing), Project management skills Analytical skills (client base analysis, marketing research, client profile, database segmentation, TA definition) The skills of working with BPMN Business Process Modeling System	System Analyst (SA)  IT Project Manager (PM)
Personal	Self-confidence, Logical thinking	
Social	Ability to conduct presentations, negotiation skills The ability to create and maintain a long-term relationship with the client	
Managerial	Ability to monitor and bring workflow to their full completion	IS_S SA PM
PP	The skills of working with ERP systems	
Professional production	Skills in testing API, web and mobile applications Knowledge of Unix shell / awk Deep knowledge of Oracle 11 DBMS, SQL programming lan-	IS_S SA

	guages, PL / SQL	
PP	Knowledge of the advertising market	IR_S PM
	Knowledge of graphic editors	
Personal	Утукпнб erudition	
Personal	Ability to work with search engines	IR_S, SA
PP	Web design	IR_S, IS_S

## APPENDIX 2.4

ДОДАТОК ДО ДИПЛОМА ПРО ВИЩУ  
ОСВІТУ

## DIPLOMA SUPPLEMENT

Серія, реєстраційний номер та дата видачі диплома  
Series, registration number and date of issue of the diploma

**M18 № від/он**

Реєстраційний номер та дата видачі додатка  
Registration number and date of issue of the supplement

**№ ФІТ-45/18 від/он 31.01.2018**

(без диплома не дійсний/not valid without diploma)

### 1. ІНФОРМАЦІЯ ПРО ВИПУСКНИКА INFORMATION ABOUT THE GRADUATE

1.1. Прізвище  
Family name(s)

1.2. Ім'я та по батькові  
Given name(s)

1.3. Дата народження  
Date of birth

### 2. ІНФОРМАЦІЯ ПРО ЗДОБУТУ КВАЛІФІКАЦІЮ INFORMATION ABOUT THE QUALIFICATION

2.1. Кваліфікація випускника: ступінь вищої освіти, спеціальність, освітня програма, професійна кваліфікація  
Qualification: Degree, Program Subject Area, Educational Program, Professional Qualification

Магістр, 124 Системний аналіз, Системний аналіз і управління, 2139.2 Професіонал з обчислень в галузі системного аналізу  
Master's degree, System analysis, System analysis and management, Expert in system analysis computations

2.2. Галузь знань  
Field of Study

Інформаційні технології  
Information technology

2.3. Найменування і статус навчального закладу, який виконував освітню програму та присвоїв кваліфікацію  
Name and status of the higher education institution that delivered the study program and conferred the qualification

Національний технічний університет "Дніпровська політехніка". Державної форми власності.  
National Technical University "Dnipro Polytechnic". State-maintained.

2.4. Мова(и) навчання  
Language(s) of instruction

Українська  
Ukrainian

### 3. ІНФОРМАЦІЯ ПРО РІВЕНЬ КВАЛІФІКАЦІЇ ЗА НАЦІОНАЛЬНОЮ РАМКОЮ КВАЛІФІКАЦІЙ INFORMATION ABOUT THE LEVEL OF THE QUALIFICATION

3.1. Рівень кваліфікації  
Level of qualification

Здатність розв'язувати складні задачі і проблеми у певній галузі професійної діяльності або у процесі навчання, що передбачає проведення досліджень та/або здійснення інновацій та характеризується невизначеністю умов і вимог.  
Ability to solve complex problems and tasks in a given professional activity field either while studying which supposes researching and/or innovations implementation under ambiguous conditions and requirements.

3.2. Офіційна тривалість програми  
Official duration of programme

1 рік 5 місяців, денна форма навчання (90 кредитів ЄКТС)

1 year 5 months, full-time form of studies (90 credits ECTS)

### 3.3. Вимоги до вступу

#### Access requirements(s)

Освітньо-кваліфікаційний рівень бакалавра, на основі результатів фахових вступних випробувань  
Education and qualification level of a Bachelor on the basis of admission tests in profession

### 4. ІНФОРМАЦІЯ ПРО ЗМІСТ ТА РЕЗУЛЬТАТИ НАВЧАННЯ

#### INFORMATION ABOUT THE CONTENT OF TRAINING AND ITS OUTCOMES

#### 4.1. Форма навчання

##### Mode of study

Денна / Full-time

#### 4.2. Вимоги освітньої програми

##### Educational Programme Requirements

Студент повинен виконати програму підготовки згідно навчального плану, який включає:

- теоретичне навчання (60 кредитів ECTS) по дисциплінам у вигляді аудиторних занять (лекційні, семінарські, лабораторні і практичні заняття) і самостійної роботи;
- проходження виробничої практики (6 кредитів ECTS) та переддипломної практики (3 кредити ECTS);
- підсумкова державна атестація, що включає в себе кваліфікаційну роботу магістра (21 кредит ECTS).

Кредити студенту зараховуються у випадку успішного (критерії оцінювання наведені в п. 4.4) складання письмових (усних) заліків або екзаменів з навчальної дисципліни, захисту курсової роботи, захисту звіту з практики, проходження підсумкової державної атестації.

Кредити студенту зараховуються у випадку успішного (критерії оцінювання наведені в п.4.4) складання письмових (усних) заліків або екзаменів з навчальних дисциплін, захисту курсових робіт, захисту звітів з практик, проходження підсумкової атестації.

Learner must satisfy the programme requirements in the Programme Specification, which includes:

- theoretical education (60 ECTS) in disciplines of classroom-based type (lectures, seminars, laboratory and practical trainings) and independent work;
- Industrial practical training (6 ECTS credits) and Pre-diploma practical training (3 ECTS credits);
- Final state certification, which includes Master Qualification Thesis (21 ECTS credits).

Credits are granted in case of successful (evaluation criteria listed in paragraph 4.4) passing written (oral) tests or exams in an academic discipline, defence of a Term paper, defence of a practice report, final state certification.

Credits are assigned to the student when he/she successfully (see Grading scheme in 4.4) passes written (or oral) tests and examinations in subjects, defends course papers, reports results of his/her practical training, passes final examinations.

Набуті компетентності:

Знання і розуміння:

- уявлення про філософські проблеми наукового пізнання та педагогіки вищої школи, що сприяють розвитку науково-педагогічних здатностей особистості;
- знання про методи, засоби та форми організації навчального процесу у вищій школі;
- знання, необхідні для розробки, впровадження і використання математичних моделей, методів і алгоритмів у різних галузях науки і виробництва;
- уявлення про принципи і засоби збору, систематизації, узагальнення інформації для проведення наукових досліджень за профілем спеціальності; знання методики наукових досліджень;
- сучасні уявлення про принципи структурної і функціональної організації складних об'єктів і систем;
- базові знання організаційної структури управління підприємством, питань управління персоналом та розробки управлінського рішення;
- базові знання з питань охорони праці і навколишнього середовища, відомих заходів з охорони праці та пожежної безпеки;
- поглиблені знання методів статистичного моделювання, короткострокового та довгострокового прогнозування, систем та процесу статистичного аналізу; поглиблені знання з основ системного аналізу.

Застосування знань і розуміння:

- здійснення розробки, аналізу та обґрунтування математичних моделей;
- виконання складних економічних, статистичних, технологічних розрахунків і прогнозів;
- вміння розробляти, використовувати та підтримувати інформаційні бази, банки даних та програмне забезпечення для аналізу і оптимізації складних процесів;
- здатність використовувати знання, уміння і практичні навички в галузі математики, інформатики, моделювання, прогнозування та теорії прийняття рішень при дослідженні соціально-економічних явищ, технічних систем та організації складних проектів.

Формування суджень:

- здатність планувати, організовувати та вести науково-дослідну роботу;
- здатність застосовувати раціональні методи пошуку, відбору та використання необхідної для роботи інформації;
- здатність розробляти математичні моделі в сфері науки, техніки і економіки;
- здатність проводити всі необхідні дослідження, здійснювати обробку одержаних даних та оформлювати результати дослідження;

The competences acquired:

Knowledge and understanding:

- conception of philosophical problems of scientific knowledge and pedagogy of the higher school (higher educational institutions), which conduce to the development of scientific and pedagogical personal skills;
- conception of methods, techniques and forms of educational process organization in higher school;
- knowledge required for development, implementation and application of mathematical models, methods and algorithms in various fields of science and industry;
- conception of principles and techniques of gathering, systematization and generalization of information for carrying out scientific research within the field of study; conception of scientific research techniques;
- modern conception of structural and functional organization principles for complex objects and systems;
- basic knowledge in organizational structure of business management, personnel management and managerial decision making;
- basic knowledge in labor safety and environment protection, certain measures of labor and fire safety;
- advanced knowledge of statistical modeling methods, short- and long-term prognostication methods, systems and procedures of statistical analysis; advanced knowledge of foundations of system analysis.

Application of knowledge and understanding :

- to develop mathematical models as well as conduct their analysis and substantiation;
- to carry out the complex economical, statistical and technological calculations and projections;
- to be able to develop, use and maintain information bases, data banks and software for analysis and optimization of complex processes;
- to master methods of statistical information processing and modern prognosis methods;
- to be able to apply knowledge, competences and practical skills in mathematics, information science, modeling, prognostics and decision making theory required for studying social and economic phenomena, technical systems and complex project organization.

Making judgments:

- ability to plan, organize and carry out scientific researches;
- the ability to use efficient methods of searching, selection and use of necessary information;
- the ability to develop mathematical models in scientific, technical and economical fields;
- the ability to carry out all necessary research, realizing obtained data processing and drawing the results;

#### 4.3. Детальні відомості про освітні компоненти та результати навчання, у тому числі оцінки, години, кредити, рейтинги, бали за національною шкалою та Європейською кредитною трансферно-накопичувальною системою

**Detailed information about the educational components and learning outcomes, including grades, academic hours, credits, rating points, scores according to the national scale and the European credit transfer accumulative system**

Номер за порядком або код/ Course unit code	Назва дисципліни/Course title	Години / Hours	ECTS credits/ Кредити ECTS	Бали/Grades	Оцінка за національною шкалою/ National grade	Рейтинг ECTS/ ECTS rating
1	Аналіз господарчої діяльності підприємства / Enterprise Economical Activity Analysis	120	4	97	Відмінно / Excellent	A
2	Іноземна мова (для академічних цілей) / Foreign Language (for Academic Purposes)	150	5	96	Відмінно / Excellent	A
3	Інтегровані системи управління / Integrated Management Systems	225	7,5	95	Відмінно / Excellent	A
4	Інтелектуальна власність / Intellectual Property	90	3	82	Добре / Good	B
5	Інтелектуальний аналіз даних / Intellectual Data Analysis	180	6	100	Відмінно / Excellent	A
6	Інформаційні системи в економіці та бізнесі / Information Systems in Economy and Business	150	5	90	Відмінно / Excellent	A
7	Методологія наукових досліджень / Methodology of Scientific Research	90	3	95	Відмінно / Excellent	A
8	Основи логістики / Basics of Logistics	195	6,5	92	Відмінно / Excellent	A
9	Охорона праці в галузі / Labour Safety in the Branch	90	3	92	Відмінно / Excellent	A
10	Педагогіка вищої школи / Higher School Pedagogy	90	3	88	Добре / Good	B
11	Самонавчання складних систем / Self-Education in Complex Systems	180	6	95	Відмінно / Excellent	A

12	Управління проектами / Project Management	150	5	95	Відмінно / Excellent	A
13	Філософські проблеми наукових досліджень / Philosophical Issues of Scientific Research	90	3	90	Відмінно / Excellent	A

**Практики / Practical training**

14	Виробнича практика / Industrial Practical Training	180	6	95	Відмінно / Excellent	A
15	Переддипломна практика / Pre-Diploma Practical Training	90	3	95	Відмінно / Excellent	A

**Курсові роботи (проекти) / Academic year papers****Атестація / Certification**

16	Кваліфікаційна робота магістра "Розробка системи підтримки та прийняття рішень при відкритті закладу ресторанного господарства" / Master Qualification Thesis "Develop of a support and decision-making system to open a restaurant as a public catering enterprise."	630	21	95	Відмінно / Excellent	A
	<b>Всього кредитів ЕКТС / Total credits ECTS</b>		<b>90</b>			
	<b>Підсумкова оцінка / Total grade and rank</b>			<b>93</b>	<b>Відмінно / Excellent</b>	<b>A</b>

**4.4. Схема оцінювання у вищому навчальному закладі (довідник із розподілу оцінок)****Grading scheme in higher education institutions (reference book on grades distribution)**

Оцінка за національною шкалою / National grade	Мін. бал / Min. grade	Макс.бал / Max. grade
<b>Національна диференційована шкала / National differentiated grade</b>		
Відмінно / Excellent	90	100
Добре / Good	74	89
Задовільно / Satisfactory	60	73
Незадовільно / Fail	0	59
<b>Національна недиференційована шкала / National undifferentiated grade</b>		
Зараховано / Passed	60	100
Не зараховано / Fail	0	59
<b>Шкала ECTS / ECTS grade</b>		
A	90	100
B	82	89
C	74	81
D	64	73
E	60	63
Fx	35	59
F	1	34

Оцінки «Відмінно», «Добре», «Задовільно» виставляються: за підсумками екзаменів та диференційованих заліків, за результатами виконання курсових і дипломних робіт (проектів), за результатами практик. Оцінка «Зараховано» виставляється за підсумками заліків.

«Excellent», «Good», «Satisfactory» grades show the results of: examinations, differentiated tests, yearly papers (projects) and theses (diploma projects), work placements. «Pass» shows the results of tests.

**4.5. Загальна класифікація присвоєної кваліфікації****Qualification within the general classification of qualifications****Диплом/Diploma**

Класифікація кваліфікації/ Classification system	Критерії/ Criteria
Диплом з відзнакою/ Diploma with honours	не менше 75 відсотків відмінних оцінок з усіх навчальних дисциплін та практичної підготовки, з оцінками "добре" з інших дисциплін та з оцінками "відмінно" за результатами державної атестації. Over 75% of grades are "excellent", no "satisfactory", only "excellent" grades for a state examination.

Диплом/ Diploma	успішне виконання програми підготовки successful completion of a study programme
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## 5. ІНФОРМАЦІЯ ПРО АКАДЕМІЧНІ ТА ПРОФЕСІЙНІ ПРАВА INFORMATION ABOUT ACADEMIC AND PROFESSIONAL RIGHTS

### 5.1. Академічні права

#### Academic rights

Доступ до навчання в аспірантурі у відповідності до одержаної спеціальності/Holders of this degree are eligible to apply to the Third Cycle Programme leading to Candidate of Sciences Degree in the corresponding field

### 5.2. Професійні права

#### Professional status

Робота за фахом./Employment in the field of specialization.

## 6. ДОДАТКОВА ІНФОРМАЦІЯ ADDITIONAL INFORMATION

### 6.1. Тривалість навчання

#### Duration of training

01.09.2016-31.01.2018 "Національний технічний університет "Дніпровська політехніка"" / National Technical University "Dnipro Polytechnic"

### 6.2. Інформація про атестацію

#### Information on certification

За результатами захисту кваліфікаційної роботи за темою "Розробка системи підтримки та прийняття рішень при відкритті закладу ресторанного господарства", рішенням екзаменаційної комісії під головуванням Пасічника Анатолія Миколайовича, д.ф.-м.н., професора кафедри транспортних систем та технологій Університету митної служби та фінансів, присвоєна кваліфікація "Магістр, 124 Системний аналіз, Системний аналіз і управління, 2139.2 Професіонал з обчислень в галузі системного аналізу". According to the results of the qualification work on "Develop of a support and decision-making system to open a restaurant as a public catering enterprise" by the decision of the Examination committee headed by A. N. Pasichnyk, Ph.D., Prof. of Mathematics, professor of transport systems and technologies department of University of Customs and Finance, the qualification "Master's degree, System analysis, System analysis and management, Expert in system analysis computations" is awarded.

### 6.3. Контактна інформація вищого навчального закладу

#### Contacts of the institution of higher education

З більш детальною інформацією можна ознайомитись: 49005 м.Дніпро, проспект Дмитра Яворницького, 19, сайт: <http://www.nmu.org.ua>; email: [rector@nmu.org.ua](mailto:rector@nmu.org.ua); телефон: +38-056-744-62-11. More detailed information can be found: Ukraine, 49005, Dnipro, Dmitry Yavornitsky Avenue, 19; website: <http://www.nmu.org.ua>; e-mail: [rector@nmu.org.ua](mailto:rector@nmu.org.ua); phone: +38-056-744-62-11.

### 6.4. Інформація про попередній документ про освіту

#### Information about the previous document of education

Диплом бакалавра/Diploma of Bachelor: B16 235023

Попередня спеціальність/Previous speciality: Системний аналіз і управління/System analysis and management

Попередня кваліфікація/Previous qualification: фахівець в галузі обчислень (комп'ютеризації), системний аналітик/Specialist in the Computing Field (Computerization), System Analyst

## 7. ЗАСВІДЧЕННЯ ДОДАТКА ДО ДІПЛОМА CERTIFICATION OF THE SUPPLEMENT

7.1. Посада керівника вищого навчального закладу або іншої уповноваженої особи вищого навчального закладу

Position of the head of the higher education institution or another authorized person

Перший проректор / First Vice-Rector

7.4. Печатка вищого навчального закладу

7.2. Підпис керівника вищого навчального закладу або іншої уповноваженої особи вищого навчального закладу

Signature of the head of the higher education institution or another authorized person

7.3. Прізвище та ініціали керівника вищого навчального закладу або іншої уповноваженої особи вищого навчального закладу

Name and initials of the head of the higher education institution or another authorized person

О.О. Азюковський /  
Oleksandr Aziukovskyi

7.5. Дата (день/місяць/рік)

Seal of the institution of higher education

Date (day/month/year)

31.01.2018

**8. ІНФОРМАЦІЯ ПРО НАЦІОНАЛЬНУ СИСТЕМУ ВИЩОЇ ОСВІТИ****INFORMATION ABOUT THE NATIONAL SYSTEM OF HIGHER EDUCATION**

Законодавство України про вищу освіту базується на Конституції України і складається із законів України «Про освіту», «Про вищу освіту», «Про наукову і науково-технічну діяльність» та інших нормативно-правових актів, міжнародних договорів України, укладених в установленому законом порядку.

Підготовка фахівців з вищою освітою здійснюється на таких рівнях вищої освіти:

початковий рівень (короткий цикл) вищої освіти, який відповідає п'ятому кваліфікаційному рівню Національної рамки кваліфікацій;

перший (бакалаврський) рівень вищої освіти відповідає шостому кваліфікаційному рівню Національної рамки кваліфікацій;

другий (магістерський) рівень вищої освіти відповідає сьомому кваліфікаційному рівню Національної рамки кваліфікацій;

третій (освітньо-науковий) рівень вищої освіти відповідає восьмому кваліфікаційному рівню Національної рамки кваліфікацій;

-науковий рівень вищої освіти відповідає дев'ятому кваліфікаційному рівню Національної рамки кваліфікацій.

Здобуття вищої освіти на кожному рівні вищої освіти передбачає успішне виконання особою відповідної освітньої (освітньо-професійної чи освітньо-наукової) програми, що є підставою для присудження відповідного ступеня вищої освіти: молодший бакалавр; бакалавр; магістр; доктор філософії; доктор наук.

Молодший бакалавр - це освітньо-професійний ступінь, що здобувається на початковому рівні вищої освіти і присуджується вищим навчальним закладом у результаті успішного виконання здобувачем вищої освіти освітньо-професійної програми, обсяг якої становить 90-120 кредитів ЄКТС.

Бакалавр - це освітній ступінь, що здобувається на першому рівні вищої освіти та присуджується вищим навчальним закладом у результаті успішного виконання здобувачем вищої освіти освітньо-професійної програми, обсяг якої становить 180-240 кредитів ЄКТС. Обсяг освітньо-професійної програми для здобуття ступеня бакалавра на основі ступеня молодшого бакалавра визначається вищим навчальним закладом.

Магістр - це освітній ступінь, що здобувається на другому рівні вищої освіти та присуджується вищим навчальним закладом у результаті успішного виконання здобувачем вищої освіти відповідної освітньої програми. Ступінь магістра здобувається за освітньо-професійною або за освітньо-науковою програмою. Обсяг освітньо-професійної програми підготовки магістра становить 90-120 кредитів ЄКТС, обсяг освітньо-наукової програми - 120 кредитів ЄКТС.

Ступінь магістра медичного, фармацевтичного або ветеринарного спрямування здобувається на основі повної загальної середньої освіти і присуджується вищим навчальним закладом у результаті успішного виконання здобувачем вищої освіти відповідної освітньої програми, обсяг якої становить 300-360 кредитів ЄКТС.

Освітня діяльність за освітньо-кваліфікаційним рівнем спеціаліста, що провадиться вищими навчальними закладами і започаткована до набрання чинності Законом України «Про вищу освіту», продовжується у межах строку навчання за певною освітньо-професійною програмою з видачею державного документа про вищу освіту встановленого зразка - диплома спеціаліста. Останній прийом на здобуття освітньо-кваліфікаційного рівня спеціаліста проводиться у 2016 році. Вища освіта за освітньо-кваліфікаційним рівнем спеціаліста (повна вища освіта) після набрання чинності Законом України «Про вищу освіту» прирівнюється до вищої освіти ступеня магістра.

Особі, яка успішно виконала відповідну освітню програму та пройшла атестацію, видається документ про вищу освіту за відповідними ступенями: диплом молодшого бакалавра; диплом бакалавра; диплом магістра; диплом доктора філософії; диплом доктора наук. Невід'ємною частиною диплома бакалавра, магістра є додаток до диплома європейського зразка, що містить структуровану інформацію про завершене навчання.

Система забезпечення якості вищої освіти в Україні складається із:

- системи забезпечення вищими навчальними закладами якості освітньої діяльності та якості вищої освіти (система внутрішнього забезпечення якості);

- системи зовнішнього забезпечення якості освітньої діяльності вищих навчальних закладів та якості вищої освіти;

- системи забезпечення якості діяльності Національного агентства із забезпечення якості вищої освіти і незалежних установ оцінювання та забезпечення якості вищої освіти.

З більш детальною інформацією про національну систему вищої освіти можна ознайомитись: <http://www.mon.gov.ua/>.

Ukraine's higher education system is regulated by the Constitution of Ukraine, the Laws of Ukraine "On Education", "On Higher Education", "On Scientific, Research and Development Activity", by ministerial and central government orders, and by international agreements which Ukraine has concluded in compliance with domestic and international law.

Education and training in Ukraine's higher education system is delivered at the following higher education levels:

- Initial level (short cycle) of higher education, which corresponds to Qualification Level Five in the National Qualifications Framework;

- First level of higher education (bachelor level), which corresponds to Qualification Level Six in the National Qualifications Framework;

- Second level of higher education (master level), which corresponds to Qualification Level Seven in the National Qualifications Framework;

- Third level of higher education (doctoral level), which corresponds to Qualification Level Eight in the National Qualifications Framework;
- Research level of higher education (habilitation), which corresponds to Qualification Level Nine in the National Qualifications Framework;

Attaining higher education at each of these levels requires successful completion of a relevant programme of study (vocational or academic) or research programme that leads to the award of a relevant higher education degree: junior bachelor; bachelor; master; doctor of philosophy; doctor of sciences.

Junior bachelor is a vocational degree acquired at the initial (short-cycle) level of higher education, and is awarded by a higher education institution upon successful completion by the student of a vocational programme of study comprised of 90-120 ECTS credits.

Bachelor is a degree acquired at the First level of higher education, and is awarded by a higher education institution upon successful completion of a professionally oriented bachelor programme comprised of 180-240 ECTS credits. The workload required for the award of a bachelor degree to a student who is continuing studies after having been awarded a relevant junior bachelor degree shall be defined by the higher education institution.

Master is a degree acquired at the Second level of higher education, and is awarded by a higher education institution upon successful completion of a relevant academic or professionally oriented programme. A professionally-oriented master programme comprises 90-120 ECTS credits; an academic programme comprises 120 ECTS credits.

A Master degree in medical, pharmaceutical or veterinary fields is awarded to students who are accepted by a higher education institution after completion of full general secondary education to a relevant continuous programme of study (i.e. first and second levels combined) comprised of 300-360 ECTS credits, and is awarded upon its successful completion.

Academic competence according to the educational qualification level of "specialist", which is being provided by higher educational institutions and was started prior to enactment of the Law of Ukraine "On Higher Education", shall be continued within the time limits of the educational period according to the relevant educational and professional programme and shall result in granting state standardized document on higher education – specialist diploma. The last admission for the educational qualification level of specialist shall be conducted in 2016. Higher education according to the educational qualification level of specialist (full higher education) shall be equal to the degree of Master following the enactment of the Law of Ukraine "On Higher Education".

A document certifying the award of a higher education (research) degree is issued to a person who has successfully completed a vocational, professional, academic or research programme, and has fulfilled the attestation requirements of the relevant programme. The following types of documents are established to certify higher education (research) degrees at the relevant levels: junior bachelor diploma; bachelor diploma; master diploma; doctor of philosophy diploma; doctor of sciences diploma.

The bachelor, master, doctor of philosophy and doctor of sciences diplomas are each appended by a Diploma Supplement produced according to European standards, which provides structured information about the completed course of study.

Ukraine's system of higher education quality assurance comprises:

- a system by which higher education institutions ensure quality of education activity, and of delivered higher education programmes (the institution's internal quality assurance system);
- a system of external quality assurance for higher education institutions and higher education programmes (the national quality assurance system of higher education, including national standards for higher education institutions and for delivered programmes);
- a system of higher education programme quality assurance verification by the National Higher Education Quality Assurance Agency and by independent quality assurance agencies empowered to assess and ensure quality of higher education.

For more information about the national higher education system refer to: <http://www.mon.gov.ua/>.

### Diagram of higher education qualification levels in Ukraine

Structure of education		Levels (degrees), credential	Period of study (years, ECTS credits)	EHEA Cycle
Doktorantura (Postdoctoral research)		Doctor of Sciences, scientific degree		
Aspirantura (Doctoral studies)		Candidate of Sciences, scientific degree	4 years (30-60 ECTS)	Third cycle
Higher education	Complete higher education	Master, Diploma of Master	1-2 years (60-120 ECTS) (1-3 years in medicine, veterinary medicine)	Second cycle
		Specialist, Diploma of Specialist	1-1,5 years (60-90 ECTS) (5-6 years in medicine, veterinary medicine (300-360 ECTS))	

	Basic higher education	Bachelor, Diploma of Bachelor	3-4 years (180-240 ECTS) (2-3 years on the basis of the Diploma of Junior Specialist)	First cycle
	Incomplete higher education	Junior Specialist, Diploma of Junior Specialist	2-3 years (120-180 ECTS) (3-4 years on the basis of /SCED 2)	Short cycle (within or linked to the first cycle)
Vocational education		Qualified Worker, Diploma	3 years (on the basis of /SCED 2) 1-1.5 year (on the basis of /SCED 3)	Entry to higher education
General secondary education	Complete general secondary education (/SCED 3)	Atestat 2-3 years (Matriculation School Leaving Certificate)	2-3 years	
	Basic general secondary education (/SCED 2)	Certificate (School Leaving Certificate)	5 years	
	Primary education (/SCED 1)		4 years	
Pre-primary education (/SCED 0)				

У разі наявності в дипломі будь-яких розбіжностей перевагу має текст українською мовою / In case of any differences in interpretation of the information in the diploma or supplement, the Ukrainian text shall prevail

## **APPENDIX 2.5**

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE  
State Higher Education Institution  
«National Mining University»**

«APPROVED»

Rector

\_\_\_\_\_ (G.Pivnyak)

26.06.17

**TENTATIVE  
EDUCATIONAL AND PROFESSIONAL PROGRAMME  
«System Analysis and Control»**

Second level of higher education

Leading to Master degree

In the speciality: 124 System Analysis

In the learning area: **12 Information Technologies**

Vetted and approved  
at the meeting of the Academic Board  
26.06.2017 minutes № 11

Put into effect by the Order of  
Rector from 26.06.2017

Dnipro  
2017  
NMU

## INTRODUCTION

The educational program is developed by the project group consisting of:

Group head's and members' surnames, names and patronymics	Job title (for part-time employees – primary employment, job title)	Institution of graduation (graduation year, speciality, qualification according to the document of higher education)	Academic degree, academic speciality code and subject area, dissertation theme, academic rank, department (speciality)	Duration of scientific and pedagogical activities and/or scientific activities (years)	Information about scientific activity (main publications in the subject area, research work, participation in conferences and seminars, work with post-graduate and doctoral students, academic advising)	Відомості про підвищення кваліфікації викладача (найменування закладу, вид документа, тема, дата видачі)
<b>Head of the project group</b>						
Slesarev Volodymyr Viktorovich	Head of System Analysis and Control Department, Professor	Dnipropetrovsk Mining Institute, 1976, majoring in Automation and Teleautomatics, electrical engineer	Doctor of Technical Sciences, 05.13.07 – Automation of technological processes, Professor of System Analysis and Control Department, doctoral dissertation “Automation of energy intensive flow technologies control at ore mining and smelting factories”	39	<ol style="list-style-type: none"> <li>1. Slesarev V. V. Upravljenija transportom na ugol'noj shahte pri ispol'zovanii sistemy raschetnogo obosno-vanija. / Malienko A. V., Slesarev V. V. // Nacional'nyj gornyj universitet. Nauko-vij visnik.- Vypusk (1). - Dnepropetrovsk, 2014. - S.62 –662. (Rus)</li> <li>2. Malienko A. V Algoritm upravljenija proizvodstven-nym kompleksom na osnove tehnologii raschetnogo obos-novanija dispetcherizacii ugol'nyh shaht./ Malienko A. V., Slesarev V. V. // XI-ja Me-zhdunarodnaja konferencija “Problemy ispol'zovanija informacionnyh tehnologij v sfere obrazovanija, nauki i promyshlennosti» (26-27 fe-vralja 2014); Sb. nauch. Tr. Nac. Gorn .un-ta /- D.: Nacional'nyj gornyj univer-sitet, 2014. - №. Str (Rus)</li> <li>3. Slesarev V.V., Mirgorodskij A.V. Metod poiska optimal'nyh reshenij sis temy upravljenija processami likvidacii avarij na shahtah // Sb. nauchnyh trudov NGU. №48. – 2015.- S. 164 – 171. (Rus)</li> <li>4. Slesarev V.V., Margitich V.S. Ontologicheskaja model' bazy znaniy upravljenija</li> </ol>	Центр інженерної педагогіки IGIP Державного ВНЗ «Національний гірничий університет» на тему «Поняття множин та їх властивості» Свідоцтво про підвищення кваліфікації від 21 травня 2014 реєстраційний № 026

					<p>silami i sredstvami pri likvidacii avarij na shahtah // Sb. nauchnyh trudov NGU. №49. – 2015.- S. 172 – 179. (Rus)</p> <p>5. V. Slesarev Probability estimates for the operation modes of mining machinery and equipment overshooting the limits of their normal functioning. / V. Slesarev, A. Malienko // Progressive Technologies of Coal, Coalbed Methane, and Ores Mining – Bondarenko, Kovalevs'ka &amp; Ganushevych (eds) 2015 Taylor &amp; Francis Group, London, P.393-395.</p> <p>6. Slesarev V. V. Upravlenija transportom na ugol'noj shahte pri ispol'zovanii sistemy raschetnogo obosnovanija. / Malienko A. V., Slesarev V. V. // Nacional'nyj gornyj universitet. Naukovij visnik.- Vypusk (1). - Dnepropetrovsk, 2014. - S.62 –66. (Rus)</p> <p>7. Zheldak T.A. The algorithm of artificial immune system simulation with Saaty selection operator and one-dimensional local search / T. A. Zheldak, V. V. Slesarev, I. G. Gulina // Naukovij visnik Nacional'nogo girnichogo universitetu. – 2016. - №5 – s. 149–156.</p> <p>Supervises one post-graduate student, has prepared 3 post-graduate students for defense. Takes part in the department research activities. Conducts instruction for Specialists and Masters.</p>	
Project group members						
Novitskii Igor Valeriovych	Professor of System Analysis and Control Department	Dnipropetrovsk Mining Institute, 1979, majoring in Automation and Teleautomatics, electrical engineer	Doctor of Technical Sciences, 1993, “Automatic optimization of ore self-grinding in tumbling mills”, Professor of System Analysis and Control Department	37	<p>1 Novickij I.V., Shevchenko Ju.A “Razrabotka i issledovanie adaptivnoj sistemy upravlenija zagruzkoj barabannyh mel'nic” / Zbirnik naukovih prac' "XI mizhnarodna konferencija z problem vikoristannja informacijnih tehnologij v osviti,nauci ta promislovosti". – D.: DVNZ «Nacional'nij girnichij universitet», 2014. (Rus)</p> <p>2. Shevchenko Ju.O. Rozrobka ta doslidzhennja adaptivnoi' systemy upravlinnja zavantazhennja barabannyh mlyniv / I.V.Novyc'kyj,</p>	Центр інженерної педагогіки IGIP Державного ВНЗ «Національний гірничий університет» Свідоцтво про підвищення кваліфікації від 21 травня 2014 реєстраційний № 027

					<p>Ju.O.Shevchenko // Materialy mizhnarodnoi' konferencii' z problem vykorystannja informacijnyh tehnologij v osviti, nauci ta promyslovosti. - D.: DVNZ «Nacional'nyj girnychij universytet», 2014. (Ukr)</p> <p>3. Novyckyj Y.V. Razrabotka metoda ydentyfikacyi dlja zadach adaptivnogo upravlenija podgotovytel'nyimi processami obogashhenija rud / Y.V.Novyckyj, Ju.A.Shevchenko // Zbirn. nauk. prac' NGU, №48, 2016, stor 5. (Rus)</p> <p>4. Novitsky I.V. Adaptive System of Controlling The Coarse Crushing Process // I.V. Novitsky, A.M. Us / Sistemnye tehnologii. T.4 (105). 2016. S.69 – 75.</p> <p>5. Novyckyj I.V., Us S.A. Vypadkovi procesy. Navch. posibn.// Dnipropetrovs'k, NGU, 2014, 132 s (Ukr)</p> <p>6. Novyckyj I.V. Suchasna teorija keruvannja: navch. posib./I.V. Novyckyj, S.A. Us, m-vo osvity i nauky Ukrai'ny, Nac. girn. un-t. – Dnipro: NGU, 2017. – 263. (Ukr)</p> <p>Conducts instruction for Specialists and Masters.</p>	
Zheldak Timur Anatolijovych	Associate Professor of System Analysis and Control Department	Dnipropetrovsk State Mining Academy (1997), Electric drive and automation of industrial plants and technological complexes, electromechanical engineer	Candidate of Technical Sciences, 05.09.03 “Electro-technical complexes and systems”. Dissertation “Parameters intensification of the induction motor with a cage rotor as a part of the automated complex”, Associate Professor of System Analysis and Control Department		<p>1. Zheldak T.A. Zastosuvannja zvorotnyh zalezhnostej u matematychnykh modeljah skladnyh ob'ektiv ta system / T.A. Zheldak // Systemni doslidzhennja ta informacijni tehnologii'. — 2012. — № 3. — S. 95–106. (Ukr)</p> <p>2. Slesaryev, V.V. Using of the Tabu search method in optimization the rolled stock layout / V.V. Slesaryev, T.A. Zheldak, D.M. Garanzha and O.D. Stanina // Scientific Reports on Resource Issues. Vol. 2, 2012: Rock Strength, Rock Fragmentation and Effective Use of Energy Potential of Geotechnical Systems. – TU Bergacademie Freiberg. – p. 87-99.</p> <p>3. Sljesarjev V.V. Matematychna model' material'no-teplovogo balansu plavky v kysnevomu konverteri ta kryterij ii' optymizacii' / V.V. Sljesarjev, T.A. Zheldak // Naukovyj visnyk Nacional'nogo gimychnogo universytetu.</p>	Докторантура при ДВНЗ «НГУ» 2010-2013 pp.

					<p>– 2013. - №1 – s. 97–102. (Ukr)</p> <p>4. Zheldak T.A. Adaptacija metodu modeljubvannja kolonii' murah do rozv'jazannja kombinatoryh zadach planuvannja vykonannja zamoven' metalurgijnyh pidprijemstvamy // Matematychni mashyny ta systemy. – 2013. - №4 – s 95-106. (Ukr)</p> <p>5. Zheldak T.A. Metod modeljubvannja shtuchoi' imunnoi' systemy z selektyvnym operatorom Saati ta odnovymirnym lokal'nym poshukom / T.A. Zheldak, V.V. Sljesarjev // Yskusstvennyj yntellekt. – 2013. №4. – s. 101-112. (Ukr)</p> <p>6. Zheldak, T.A. Knowledge-Based Intellectual DSS of Steel Deoxidation in BOF Production Process. / T.A. Zheldak, V.V. Slesarev, and D.O. Volovenko // American Journal of Mining and Metallurgy 1.1 (2013): 7-10.</p> <p>7. T.A., Zheldak, and Redko V. "Using an Evolutionary Heuristics for Solving the Outdoor Advertising Optimization Problem." Journal of Computer Sciences and Applications 2.2 (2014): 23-30. DOI: 10.12691/jcsa-2-2-2.</p> <p>8. Zheldak T.A. The algorithm of artificial immune system simulation with Saaty selection operator and onedimensional local search / T. A. Zheldak, V. V. Slesarev, I. G. Gulina // Naukovyj visnyk Nacional'nogo girnychogo universytetu. – 2016. - №5 – s. 149–156.</p> <p>Participated in more than 40 international conferences and seminars.</p> <p>Head of the student academic society of the department</p>	
Us Svitlana Albervina	Professor of the System Analysis and Control Department	Dnipropetrovsk State University, 1987, Speciality "Applied Mathematics", diploma with high honours MB-I	Candidate of Physical and Mathematical Sciences in speciality 05.13.18 "Theoretical Basics in Mathematical Modelling, numerical methods and Software System", theme of dissertation "Solution of	30	<p>Research interests – decision making, namely, in the area of uncertainty, infinite-dimensional optimization.</p> <p>Over the last 5 years, S. Us has published over 50 scientific and pedagogical papers plus two manuals classified by the Ministry of Education and Science of Ukraine</p> <p>Major publications:</p>	<p>Centre of Engineering Pedagogics, Certificate of advanced training No. 018, graduate paper "Efficient alternatives and their properties", 21.05.2014</p> <p>Diploma IGIP No. UA-157, 2014</p>

			<p>one class of infinite-dimensional optimization problems” Diploma KH No. 000056, Associate Professor (since December, 2001) of the System Analysis and Control Department.</p>	<p>1. Us S. A. Application of the optimal set partitioning method to problem of wireless network engineering. // <b>Energy Efficiency Improvement of Geotechnical Systems - International Forum on Energy Efficiency. – CRC Press/ Balkema - Taylor &amp; Francis Group. – 2013. – P. 175–181</b></p> <p>2. Us S.A, Stanina O.D Multi-stage problem of concentration plant location // 6th International Academic Conference of Young Scientists “Computer Science and Engineering 2013” (CSE-2013) / 4th International Youth Science Festival “Litteris et Artibus” November 21–23, 2013 Lviv Polytechnic National University</p> <p>3. Kiseleva E.M. Teoriia optimalnogo rozbiennia mnozhestv v zadachakh raspoznavaniia obrazov, analiza i identifikatsii sistem (Monograph)// E.M. Kiseleva, L.S. Koriashkina, S.A. Us // Ministry of Education and Science of Ukraine; National Mining University. – D.: NMU, 2015. –270 p.</p> <p>4. Kiseleva E.M., Us S.A., Stanina O.D. O zadachakh optimalnogo rozbiennia mnozhestv s dopolnitelnymi sviaziami // Pytannia prykladnoi matematyky i matematychnoho modeliuvannia, Dnipropetrovsk, DNU Publishing Company, 2016, P. 67-78.</p> <p>5. Ishchenko A.K. Mathematical justification on the choice of explosive material to rupture strong rocks of complex structure / A.K. Ishchenko, S.A. Us, A.V. Solovev, K.S. Ishchenko // Metallurgical and Mining Industry, No. 5 – 2017, c 42 – 45</p> <p>Manuals classified by the Ministry of Education and Science of Ukraine</p> <p>1. Novytskyi I.V. Vypadkovi protsesy [Text]: manual / I.V.Novytskyi, S.A.Us. – D.: NHU, 2014, – 193 p.</p> <p>2. Us S.A., Koriashkina L.S. Modeli ta metody pryiniattia rishen [Text]: manual / S.A. Us, L.S. Koriashkina– D.: NMU. – 2014. – 300p.</p>	<p>Summer Academy within the Erasmus+ project “Quality assurance system in Ukraine: development on the base of ENQA standarts and guidelines” , University of Koblenz-Landau,10-24 july, 2016</p> <p>Training session on design of dual degree programs University of Koblenz-Landau, 11-15 december 2016</p>
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While developing the Programme draft the following requirements have been considered:

- 1) The Project of Educational Standard of Speciality 124 – System Analysis, Master’s level;
- 2) Professional standard (standards) \_\_\_\_\_ (Standard title, Standard proprietor/provider, the title of the document which validates the Standard);
- 3) Recommendations by professional association \_\_\_\_\_ (title, information on placement/publishing of the recommendations);
- 4) Recommendations \_\_\_\_\_ (the title of the organisation – a leading employer in the field, information on placement /publishing of the recommendations).

(Note – items 2-4 are provided if available)

### Normative references

The educational programme is developed on the basis of the following normative documents:

1) Law of Ukraine on Higher Education. <http://zakon5.rada.gov.ua/laws/show/1556-18>.

2) Occupational classification ДК 003:2010 [Electronic source]. – valid from 01.11.2010. – Available at: <http://dovidnyk.in.ua/directories/profesii>.

3) License terms of implementing educational activities of education institutions validated by Resolution of the Cabinet of Ministers of Ukraine of December, 30 2015 No. 1187. <http://zakon5.rada.gov.ua/laws/show/1187-2015-п/page>.

4) Methodological recommendations on developing Higher Education Standards. <http://mon.gov.ua/activity/education/reforma-osviti/naukovo-metodichna-rada-ministerstva/metodichni-rekomendacziyi.html>.

5) Order of the Ministry of Education and Science of Ukraine of 06.11.2015 No. 1151 *On Peculiarities of Implementation of List of fields of study and programme subject areas in higher education*.

6) National Qualifications Framework (NQF). <http://zakon3.rada.gov.ua/laws/show/1341-2011-п>.

## C O N T E N T S

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## 1 EDUCATIONAL PROGRAMME PROFILE

### “System Analysis and Control” of Speciality 124 System Analysis

#### 1.1 General information

##### 1.1.1 Higher education degree and qualification title

Speciality: 124 System Analysis;

Area of study: “System Analysis and Control”;

Educational Programme: “System Analysis and Control”;

Higher education degree: Master

Academic qualification: Master in System Analysis in the area of study System Analysis and Control

Vocational qualification: Expert in System Analysis Computation.

#### 1.2 Language(s) of training and assessment

Ukrainian is the language of training and assessment

#### 1.3 Volume of Educational Programme

90 ECTS credits, 1 year 4 months

#### 1.4 Programme type

Educational and professional academic.

Dual degree programme with the University of Koblenz-Landau.

#### 1.5 Full name of the higher educational institution and structural unit where training is performed

State Higher Educational Institution “National Mining University”

System Analysis and Control Department

#### 1.6 Name of the higher educational institution involved in programme support (is filled in for double degree and joint programmes)

The University of Koblenz-Landau (uni K9-LD), Rhabanusstraße 3, 55118 Mainz, Germany

#### 1.7 Official title of the educational programme, higher education level, name of the qualification of the higher educational institution (HEI) -partner in the source language (for Dual and Joint Diplomas).

Master programme "Mathematical modeling of complex systems, Master of Science".

**1.8 Accreditation**

Accredited by Ministry of Education and Science of Ukraine

Certificate of Accreditation Series HД № 485733

(issued by the MES of Ukraine Order of 24.07.15, No. 1709 п)

The Certificate is valid till 1 July, 2025.

**1.9 Programme cycle/level**

FQ-EHEA Cycle 2, EQF LLL Level 7, NQF Level 8.

**1.10 Prerequisites**

Prior education – Bachelor’s Degree in the area 12 - Information Technologies.

**1.11 Mode of education**

Full-time (day-time and evening) and extramural.

**1.12 The educational programme duration**

The programme upgrade is scheduled in 2022

**1.13 Internet address for the educational programme summary**

[http://sau.nmu.org.ua/ua/osvita/metod/magistr/Program\\_magistrCA\(2017\).pdf](http://sau.nmu.org.ua/ua/osvita/metod/magistr/Program_magistrCA(2017).pdf)

**1.14 Programme objective (in view of the qualification level)**

Training of Experts who would be able to develop and use the system analysis methods and tools in order to design and predict the behaviour of dynamic systems, control complex systems, design or upgrade the decision-making systems based on the system analysis methods.

**1.15 Specifics of the educational programme**

*1.15.1 Subject area (field of knowledge / speciality / specialization of the programme).*

Information Technologies / System Analysis / System Analysis and Control

*1.15.2 Educational programme orientation*

Educational-professional and academic

*1.15.3 Focus of the educational programme and specialization*

General education in specialization *System Analysis and Control*

*Key words:* system analysis, data analysis, complex system management, , decision-making, prediction, mathematical simulation.

#### *1.15.4 Features of the programme*

Educational, industrial and pre-diploma practical trainings are compulsory.

This programme, which is coordinated with the University of Koblenz-Landau Master's Degree Programme in Complex Systems Simulation (Agreement on a Dual Degree between National Mining University, Ukraine and University of Koblenz-Landau, Germany, 03.07.17), allows for

- national credit mobility based on the dual agreements between SHEI National Mining University and technical universities of Ukraine;
- international credit mobility on the basis of bilateral agreements between SHEI National Mining University and HEIs in foreign partner countries

Inter-institutional agreement 2017-2021 between institutions from Programme and Partner Countries , 16.10.17

Memorandum of Understanding between University of Koblenz-Landau (Germany) and State Higher Education Institution «National Mining University» (Ukraine)

### **1.16 Opportunities for employment and further education**

#### *1.16.1 Opportunities for employment*

Economic activities in accordance with the National Classification of Professions:

Section K, Chapter 72 Activities in the Field of Informatization

72.10.0 Advising in problems of informatization:

- advising as for the type and configuration of computer hardware and software use: analysis of customers' information needs and search for the optimal solutions.

72.21.0 Standard software development

- development, publishing and release (sales, hire and (or) licensing) of the system programme packages, utilities and games

72.22.0 Other activities in the field of software development

- advising in software development and assisting in technical aspects of the computer systems
- individual software development (customized) and package programmes adaptation for the customers' specific needs
- development of web-pages

- provision for system analysis services, programming and support, and other special services in the field of informatization that belong only to this particular group

#### 72.30.0 Data processing:

- data processing by means of the customers' or proprietary software
- complete data processing, their preparation and feed-in
- long-term use of the computer hardware, that belongs to other customers
- allocating space in the web

#### 72.40.0 Data-bank activities

- provision of data in a certain order or sequence through their selection or direct access (automatic data feed-in): data can be available for all the customers or for their limited number and may be custom-sorted
  - publishing any information in the Internet, including books, newspapers and magazines if they cannot be published by any other means
  - data bases development in online operation mode
  - development of catalogues, address lists etc. in operation mode
  - activities related to searching portals on the web

Professions and job titles in accordance with the National Classification of Professions:

- 2121 Experts in Mathematics
- 2122 Experts in Statistics
- 2131 Experts in Computing Systems
- 2132 Experts in Programming
- 2139 Experts in other fields of computing (computerization)
- 2310 Instructors in universities and higher education institutions

#### Professional Job Titles:

- 2121.1 Research Assistant (Mathematics)
- 2121.2 Mathematician
- 2121.2 Mathematician (Applied Mathematics)
- 2121.2 Mathematician and Analyst in Operations Research
- 2122.1 Research Assistant (Statistics)
- 2122.2 Economist-Statistician
- 2122.2 Economist-Statistician (Applied Statistics)
- 2131.2 Computer Communications Analyst
- 2131.2 Computer System Analyst
- 2131.2 Computer Data Bank Analyst
- 2131.2 Operational and Applied Software Analyst
- 2131.2 Computer Software and Multimedia Analyst
- 2131.2 Computer Systems Engineer

2131.2 Computer Software Engineer  
 2131.2 Computer Systems and Automation Research Engineer  
 2132.2 Programmer (Data Base)  
 2132.2 Applied Programmer  
 2139.1 Research Assistant (Computing)  
 2139.2 Computer Use Engineer  
 2139.2 System Engineer in Publishing and Printing Production  
 2223.8 Engineer in Automated Production Control Systems  
 2310.2 Assistant  
 2310.2 Instructors in Higher Education Institution  
 2441.2 Investment Analyst  
 2441.2 Crediting Analyst  
 2441.2 Economist in Computer Center (Data-processing center)  
 2447.2 Expert in Project Management and Programmes in Material (Intangible)  
 Production

#### *1.16.2 Further education*

Study under the third cycle programme FQ-EHEA, level eight in the EQF-LLL and Qualification Level Nine in the NQF.

### **1.17 Instruction and Assessment**

#### *1.17.1 Instruction*

Student-centered learning, self-directed study, problem based learning.

#### *1.17.2 Assessment*

Types of Assessment: current, final.

Forms of current assessment: oral and/or written examination, tests, presentation of laboratory and individual projects.

Final assessment is based on the results of current assessment or/and the results of the complex control test.

Assessment criteria of learning outcomes are manifested in the norms of grades showing the correlation between the requirements to knowledge, skills, communication, autonomy, and responsibility of a student according to the National Qualification Framework (NQF) and grade index in points.

Learning outcomes are assessed by means of rating scale (passing grades are 60...100) and conversion scale (excellent, good, satisfactory, fail) used for credits transfer.

A student should demonstrate the level of learning outcomes at no less than 60% for each component of the educational programme.

#### *1.17.3 Form of Graduate Assessment*

Graduates' assessment is carried out as the defense of qualification Master's thesis and results in granting a standardized document of Master's degree and awarding the qualification: Expert in System Analysis Computing.

## **1.18 Resource base for the Programme Implementation**

### *1.18.1 Specific characteristics of faculty staff*

The faculty staff involved into the Educational Programme Implementation should have:

- scientific degree of Doctor of Sciences, Candidate of Sciences (Doctor of Philosophy);
- academic title of Professor, Associate Professor or Senior Researcher (Senior Research Fellow);
- publications in the specialized Ukrainian or foreign scientific editions connected to the course delivered and/or student's manual or book covering the course;
- experience of practical work or the appropriate scientific and pedagogical training.

### *1.18.2 Specific characteristics of material support*

Personal computers with CPU no less than Pentium-IV(AMD K7 (Athlon)) and HDD no less than 100 Gb with Office software installed.

### *1.18.3 Specific characteristics of information and methodological support*

Additional software: R, RStudio, Deductor Studio Academic, Python

## **1.19 – Academic Mobility**

### *1.19.1 National Credit Mobility*

Based on the bilateral treaty between SHEI “NMU” and Ukrainian technical universities;

### *1.19.2 International Credit Mobility*

Agreement on a Dual Degree between National Mining University, Ukraine and University of Koblenz-Landau, Germany, 03.07.17

International Academic Mobility (Erasmus+ K1) .

### *1.19.3 Foreign Students Training*

Foreign students are eligible to enter the Master Programme *System Analysis and Control* in case they are formally enrolled (and fulfilled the same entry qualification requirements as the students of the National Mining University) and their Ukrainian or English language level corresponds to the B2 level.

## **1.20 Standard Competences**

### *1.20.1 Integral Competence*

Ability to solve complicated specialized problems and practical tasks under complex and uncertain conditions and requirements in different fields, which requires conducting research and/or innovative activity based on the theory and methods of system analysis.

### *1.20.2 Generic Competences of Master in System Analysis*

GC1 Ability for abstract and analytical thinking, and synthesis of ideas.

GC2 Ability to communicate in a second (foreign) language.

GC3 Ability to undertake research at an appropriate level.

GC4 Ability to learn and master state-of-the-art knowledge.

GC5 Ability to search for, process and analyse information from a variety of sources.

GC6 Ability to generate new ideas (creativity).

GC7 Ability to identify, pose and resolve problems.

GC8 Ability to make grounded decisions.

GC9 Ability to communicate with representatives of other professions at different levels (experts in other fields of knowledge/economic activity).

GC10 Ability to work in international context.

GC11 Ability to design and manage projects.

GC12 Conscientiousness and commitment to tasks and responsibilities.

### **1.2.2 Special Competences of a Master in Speciality 124 - System Analysis**

SC1 The ability to develop and analyze mathematical models of natural, technogenic, economic and social objects and processes.

SC2 The ability to plan and carry out systematic research, perform mathematical and information modeling of dynamic processes.

SC3 The ability to use the methodology of system analysis for decision making in complex systems of different types.

SC4 The ability to generate new hypotheses and set the research tasks in the field of system analysis and decision-making, to choose the appropriate directions for their application.

SC5 The ability to formulate, analyze and synthesize in the process of scientific problems solution at an abstract level.

SC6 The ability to design the architecture of intelligent information systems.

SC7 The ability to apply intelligent data analysis to construct DSS (decision support system), expert and advisory systems.

SC8 The ability to develop the functions of forecasting the dynamics of various kinds of processes development in a determined and stochastic environment and to assess the quality of the forecast.

SC9 The ability to apply methods of quantitative and qualitative risk assessment, development of risk management algorithms in complex systems of different nature.

SC10 The ability to apply modern information technology to solve problems of system analysis.

SC11 The ability to model, predict and design the enterprise business process on the basis of methods and tools of system analysis.

SC12 The ability to reveal situational and system uncertainties, develop conflict resolution algorithms.

SC13 The ability to conduct patent research and substantiate the patent frequency of new design solutions.

SC14 The ability to self-education and professional development.

SC15 The ability to plan and conduct scientific research, to prepare and present the results of the research activities.

SC16 The ability to understand the goals and objectives of pedagogical activity in higher education institutions.

SC17 The ability to realize the need for life-long self-education and constant self-improvement; to strive for a professional interdisciplinary approach to knowledge creation.

### **1.21 Normative learning outcomes of training in the speciality**

The final, conclusive and integrative learning outcomes that determine the normative content of the training and correlate with the above list of general and special competences are presented below.

Master must:

GLO1 Be able to speak state and foreign languages professionally, develop documentation in state and foreign languages for systems, products and services of information technologies; read, understand and apply technical documentation in Ukrainian and foreign languages in professional activity.

GLO2 Be able to search for information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources.

GLO3 Be able to process, analyze, systematize scientific and technical information, generalize advanced national and foreign experience in system analysis.

GLO4 Develop and apply creative abilities in their professional activity, organize their workplace, plan working hours.

GLO5 Demonstrate curiosity, risk management, ability to think, get inspired by new ideas, implement them, infatuate others with them, combine and experiment.

GLO6 Build links and relationships with people, take into account the views of colleagues, understand other people, show trust in the team, admit mistakes, avoid and prevent conflicts, put one's personal ambitions on hold; select and prepare information and tasks for the project team, set goals and formulate tasks for the implementation of projects and programmes.

PLO1 Know and be able to apply in practice methods of system analysis, methods of mathematical and information modeling for constructing and researching models of objects and processes of informatization.

PLO2 Know the methods of revealing uncertainties in system analysis tasks, be able to disclose situational uncertainties, and uncertainties in the problems of interaction, counteraction and conflict of strategies, find a compromise in the disclosure of conceptual uncertainty, etc.

PLO3 Know the methods of forecasting the dynamics of different types of processes, be able to develop prediction functions.

PLO4 Know and be able to apply risk precautions, evaluate and use them in the analysis of multi-factor risks of accidents and disasters.

PLO5 Be able to develop and use system-analytical risk protection tools in business processes effectively.

PLO6 Know and be able to apply evolutionary modeling and genetic optimization methods, inductive modeling techniques and fuzzy logic mathematical apparatus, neural networks, game theory and distributed artificial intelligence, etc.

PLO7 Be able to develop expert and advisory systems in conditions of poorly structured data of different nature.

PLO8 Know and be able to implement highly loaded computing and data processing systems in system analysis and control tasks, and decision support systems.

PLO9 Know the models, methods and algorithms for decision-making in situations of conflict, fuzzy information, uncertainty and risk.

PLO10 Be able to search information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources.

PLO11 Apply pedagogical technologies at the level sufficient for realization of developed programmes of educational disciplines.

PLO12 Process, analyze, systematize scientific and technical information, generalize advanced national and foreign experience in system analysis.

### **1.22 Competences for "*System Analysis and Control*" speciality**

Object of professional activity:

- mathematical methods and information technologies of complex system analysis;

- forecasting and decision making in complex systems of different nature (informational, economic, financial, social, political, technical, organizational, environmental, etc.) in conditions of uncertainty on the basis of system methodology.

PCS 1 The ability to carry out a formal description of the research tasks of operations in organizational, technical and socioeconomic systems for different purposes, to determine the optimal solutions, to build models of optimal choice of management, taking into account changes in the parameters of the economic situation, to optimize management processes in systems of different purposes and level of the hierarchy.

PCS 2 The ability to apply theoretical and practical bases of methodology and management technology, to develop algorithms for managing complex objects and systems, to conduct experiments on the control programme with processing and analysis of the results.

### **1.23 Learning outcomes in speciality "*System Analysis and Control*"**

LOS1 To know about and be able to identify (estimate) the parameters of mathematical models of control objects in real time in conditions of changing its dynamics and

under the impact of random perturbations using measured signals of input and output coordinates of the object.

LOS2 To know about and be able to implement heavily loaded computing and data processing systems to solve the system analysis and control problems, and in decision support systems.

LOS3 To be able to build typical mathematical models of objects and processes of system analysis, to use mathematical methods and algorithms for data processing (statistical, algebraic, combinatorial, theoretical-informational, etc.).

LOS4 To analyze the stability of dynamic systems, to apply stochastic regression models and models in the state space to describe the dynamics of different kinds of processes.

LOS 5 To know about the methods of economics and business organization, micro- and macroeconomics, statistical analysis of economic processes and to apply them for the organization of complex systems efficient management.

## 2 Programme learning outcomes mapping to programme components (Conformity matrix)

Programme learning outcomes	Courses, practical training, individual tasks
1	2
GLO1 Ability for professional communication in the state and foreign languages; elaboration of documentation in the state and foreign languages on systems, products and services of information technologies; reading, understanding and incorporating technical documentation in the Ukrainian and foreign languages in professional activity	Foreign Language for Professional Purposes Methodology of Scientific Research
GLO 2 Ability to search for information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources.	Methodology of Scientific Research Diploma Project
GLO 3 Ability to process, analyze, systematize scientific and technical information; generalize advanced national and foreign experience on system analysis.	Methodology of Scientific Research Diploma Project
GLO 4 Ability to develop and apply one's creative skills in professional activity; organize a workplace; planning working hours	Practical Training Pre- Diploma Practical Training Diploma Project
GLO 5 Ability for curiosity, risk assessment, thinking, inspiring and being inspired with new ideas, implementing them, combining and experimenting	Practical Training Pre-Diploma Practical Training Philosophical Problems of Scientific Research
GLO 6 Ability to establish relationships and communication with people, taking into account the views of colleagues; understand other people, cooperate in the team, acknowledging mistakes, avoiding and preventing conflicts, restraining personal ambitions. Ability to select	Practical Training Pre-graduation Practice Diploma Project

and prepare information and tasks for the project team, set goals and formulate tasks for the implementation of projects and programs.	
PLO1 Awareness of and ability to apply in practice methods of system analysis, methods of mathematical and information modeling for constructing and researching models of objects and processes of informatization.	Practical Training Pre-Diploma Practical Training Philosophical Problems of Scientific Research Diploma Project
PLO2 Awareness of the methods employed to disclose uncertainties in system analysis problems, ability for disclosing situational uncertainties, and uncertainties in the tasks of interaction, counteraction and conflict of strategies; finding a compromise in the disclosure of conceptual uncertainty, etc.	Philosophical Problems of Scientific Research Complex Systems Self-Teaching
PLO3 Awareness of the methods employed to forecast the dynamics of processes of different nature; ability to develop prediction functions.	Intellectual Data Analysis
PLO4 Awareness of and ability for applying risk levels, evaluating and using them in the analysis of multi-factor risks of accidents and disasters.	Theory of Games in the Conflict Situation Study Economic Aspect of Entrepreneurial Activity
PLO5 Ability to develop and effectively apply system-analytical risk protection tools in business processes.	Economic Aspect of Entrepreneurial Activity Analysis and Planning of the Business Environment Market
PLO6 Awareness of and ability for applying the methods of evolutionary modeling and the genetic optimization methods, inductive modeling techniques, and mathematical apparatus of fuzzy logic, neural networks, game theory and distributed artificial intelligence, etc.	Theory of Games in the Conflict Situation Study Intellectual Data Analysis Complex Systems Self-teaching
PLO7 Ability for developing expert and advisory systems in conditions of poorly structured data of different nature.	Integrated Control Systems Intellectual Data Analysis Complex Systems Self-teaching
PLO8 Awareness of and ability for implementing heavily loaded computing and data processing systems to solve system analysis and control problems, and in decision support systems.	Basics of Logistics Complex Systems Self-Teaching
PLO9 Awareness of the models, methods and algorithms for decision-making in case of a conflict, fuzzy information, uncertainty or risk.	Basics of Logistics
PLO10 Ability to search for the information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources.	Diploma Project Pre-Diploma Practical Training Foreign Language for Professional Purposes Philosophical Problems of Scientific Research
PLO11 Ability for applying pedagogical techniques at the level sufficient for realization of scheduled curricula.	Pedagogy of Higher School Philosophical Problems of Scientific Research
PLO12 Ability for processing, analyzing, systematizing scientific and technical information; generalizing	Diploma Project Pre-Diploma Practical Training

advanced national and foreign experience on systems analysis.	Foreign Language for Professional Purposes Philosophical Problems of Scientific Research
LOS1 Awareness of and ability for identifying (estimating) the parameters of mathematical models of control objects in real time under conditions of changing its dynamics and the effects of random perturbations using the measured signals of the input and output coordinates of the object.	Mathematical Modeling and Analysis of Dynamic Systems Integrated Control Systems
LOS2 Awareness of and ability for implementing heavily loaded computing and data processing systems to solve system analysis and control problems, and in decision support systems.	Intellectual Data Analysis
LOS3 Ability for plotting typical mathematical models of objects and processes of system analysis; using mathematical methods and algorithms for data processing (statistical, algebraic, combinatorial, theoretical-informational, etc.).	Discrete Optimization Methods Theory of Games in the Conflict Situation Study Intellectual Data Analysis Basics of Logistics
LOS4 Ability for analyzing the stability of dynamic systems; applying stochastic regression models and models in the state space to describe the dynamics of processes of different nature.	Mathematical Modeling and Analysis of Dynamic Systems Integrated Control Systems
LOS5 Awareness of the methods of economics and enterprise organization, micro- and macroeconomics, statistical analysis of economic processes; ability for applying them to organize complex systems efficient management.	Economic Aspect of Entrepreneurial Activity Analysis and Planning of the Business Environment Market

**Matrix of the programme components (compulsory and elective) mapping to the programme learning outcomes (PLO)**

	C C 1	CC 2	CC 3	CC 4	CC 5	CC 6	EC 1	EC 2	EC 3	EC 4	EC 5	EC 6	EC 7	EC 8	EC 9	EC 10
PLO1	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+
PLO 2			+	+	+	+	+	+	+	+	+	+	+	+		
PLO3						+			+		+	+	+	+	+	+
PLO4				+	+	+			+	+	+	+	+		+	+
PLO5				+	+	+							+			
PLO6				+	+	+			+	+	+	+	+		+	
PLO7			+	+	+	+	+		+	+	+		+	+		
PLO8				+	+	+			+	+	+		+	+		+
PLO9				+	+	+	+		+	+	+		+	+		
PLO10	+		+	+	+	+	+	+	+							
PLO11		+	+	+	+	+	+									
PLO 12	+	+	+	+	+	+	+									
LOS1			+	+	+	+	+		+	+	+	+	+	+	+	

Matrix of the programme components mapping to the programme competences

	C C 1	CC 2	CC 3	CC 4	CC 5	CC 6	EC 1	EC 2	EC 3	EC 4	EC 5	EC 6	EC 7	EC 8	EC 9	EC 10
GC1			+				+	+								
GC 2	+		+													
GC 3				+	+		+									
GC 4							+									
GC 5			+	+	+	+	+									
GC 6							+									
GC 7				+	+											
GC 8																
GC 9	+			+	+											
GC 10	+						+									
GC 11						+		+								
GC 12						+										
CS1										+	+	+	+			
CS 2							+						+	+		
CS 3						+					+			+		
CS 4													+			
CS 5			+				+									
CS 6									+		+					
CS 7									+		+					
CS 8									+		+				+	+
CS 9						+										
CS 10				+	+				+	+	+			+		
CS 11						+								+		+
CS 12													+			
CS 13							+									
CS 14									+							
CS 15						+	+									
CS 16		+														
CS 17		+	+				+									

**3 PROGRAMME STRUCTURE AND CREDITS CONFORMITY TO COMPONENTS, DEPARTMENTS;  
TERMS OF STUDY WITH RESPECT TO COMPONENTS, AND FINAL ASSESSMENT FORMS**

<b>Code #</b>	<b>Components of the educational programme (disciplines, course projects, practical trainings, graduation theses)</b>	<b>Number of credits</b>	<b>Final assessment form</b>	<b>The department of instruction</b>	<b>Distribution by quarters</b>
	<b><i>Compulsory components of EP</i></b>				
CC1	Foreign Language for Professional Purposes (English / German / French)	6	grading test	Department of Foreign Languages	1-4
CC2	Pedagogy of Higher School	3	grading test	Department of Philosophy	3
CC3	Philosophical Problems of Scientific Research	3	grading test	Department of Philosophy	3
CC4	Practical Training	8	grading test	Department of System Analysis and Control	5
CC5	Pre-Diploma Practical Training	4	grading test	Department of System Analysis and Control	5
CC6	Certification	18	defense of a diploma project	Department of System Analysis and Control	6
	Total number of compulsory components 42				
	<b><i>Elective components of EP</i></b>				
EC1	Methodology of Scientific Research	3	grading test	Department of System Analysis and Control	1-2
EC2	Economic Diagnostics of Entrepreneurial Activity	4	exam		1-2

EC3	Intellectual Data Analysis	6	exam	Department of System Analysis and Control	1-2
EC4	Fundamentals of Logistics	5	exam	Department of System Analysis and Control	3-4
EC5	Self-Teaching of Complex Systems	6	exam	Department of System Analysis and Control	3
EC6	Discrete Optimization Methods	6	grading test	Department of System Analysis and Control	1-2
EC7	Theory of Games in the Conflict Situations Research	6	grading test	Department of System Analysis and Control	1-2
EC8	Integrated Control Systems	3	grading test	Department of System Analysis and Control	3
EC9	Mathematical Modeling and Analysis of Dynamic Systems	6	grading test	Department of System Analysis and Control	4
EC10	Analysis and Planning of the Business Environment Market	3	grading test	Department of System Analysis and Control	4
	Total volume of elective components 48				
	TOTAL VOLUME OF EDUCATIONAL PROGRAMME: 90				

#### 4 STRUCTURAL AND LOGICAL DIAGRAM

Year	Term	Quarter	Coding of educational activities	The number of disciplines taught during a quarter	The number of disciplines taught during a term	The number of disciplines taught in a year
1	2	3	4	5	6	7
1	1	1	CC1, EC1, EC2, EC3, EC6, EC7	6	6	13
		2	CC1, EC1, EC2, EC3, EC6, EC7	6		

	2	3	CC1, CC2, CC3, EC4, EC5, EC8	6	8	
		4	CC1, EC4, EC9, EC10	4		
2	3	5	CC4, CC5	2	3	3
		6	CC6	1		

## 5. INTERNAL SYSTEM FOR HIGHER EDUCATION QUALITY ASSURANCE

The system of higher education quality assurance in the State Higher Education Institution "NMU" comprises the following components:

- ensuring the quality of higher education during the educational process design;
- ensuring the quality of higher education during the educational process according to the project documents (educational programmes in the speciality, syllabi of disciplines and other credit modules, educational, methodological and informational support complex of the educational process, curriculum, individual curriculum of higher education applicant, staff-wise calculation of the curriculum implementation);
- higher education quality assurance system management.

### 5.1 Competence approach to the educational process design

The quality of higher education in specialties and levels of higher education is laid out when designing an educational process based on a competence approach:

The normative part of the university's educational programmes in specialties include all competences and programme learning outcomes with the degree of complexity typical for certain levels of higher education in accordance with higher education standards;

- Justification of organizational forms nomenclature of the educational process (disciplines, individual tasks, practical trainings) is carried out by an adequate distribution of programme learning outcomes;
- learning outcomes for each learning activity are determined by decomposition and specification of programme learning outcomes to be used as criteria for selecting the content of disciplines, practical trainings, individual tasks;
- To create diagnostic methods, the planned learning outcomes for each type of educational activity of the applicant in the form of generalized and specified control tasks are used. Generalized control tasks should be provided to applicants at the beginning of disciplines teaching;
- assessment is carried out by assessing the degree of programme competence development.

Implementing competence approach to higher education design by creating an unequivocal connection of external goals of higher education with courses, practical trainings and individual tasks is crucial to higher education quality assurance and creation of a real system for its internal provision. Departments' activities related to

educational programmes, syllabi and educational, methodological and informational support complexes are regulated by the Standard "Educational process design", approved by the Academic Board of the University of 15 November 2016 (minutes № 15).

## **5.2 Indicators of higher education quality control at the University**

In accordance with the «Policy of Higher Education Quality in State Higher Education Institution «NMU»», which is approved by the Academic Board, the control of higher education quality in each speciality as for self-assessment and external evaluation of the activities at the university and its departments is carried out according to the following indicators:

- ♦ quality of higher education content;
- ♦ quality of NMU educational programmes on specialities (areas of specialization);
- ♦ quality of educational process;
- ♦ quality of the educational process participants;
- ♦ quality of educational, material and technical resources;
- ♦ quality of higher education results;
- ♦ dynamics of quality.

## **5.3 Quality control of higher education**

Higher education quality control system is a set of organizational measures, methods, processes, procedures and mechanisms by which NMU ensures the effectiveness of the internal quality system.

*The quality control system is based on the following principles:*

- ♦ organization of the system functioning with the participation of external parties;
- ♦ focus on educational services consumers;
- ♦ providing normative support to the quality policy implementation which is made in accordance with NMU standards for all indicators of quality assurance;
- ♦ ensurance of academic honesty and freedom;
- ♦ elimination of academic fraud;
- ♦ measures to prevent intolerance or discrimination of students and teachers;
- ♦ compliance with the expectations of society, students, employers and partner organizations;
- ♦ providing the quality policy with official status and accessibility to the general public;
- ♦ subordination of NMU faculty planned reporting to provisions of the «Policy of Higher Education Quality and University Development Programme».

*Mechanisms of control and creation of an effective internal quality system:*

1) review of the state of internal higher education quality assurance by the University Supervisory Board;

2) implementation of the «Measures to modernize the internal quality assurance system of State Higher Education Institution “NMU”, which are concluded in accordance with the «Standards and Recommendations on Quality Assurance in the European Higher Education Area (ESG)», approved by the University administration and carried into effect by the Rector’s order;

3) systematic monitoring of the educational disciplines teaching quality by scientific and pedagogical staff, which is carried out by the Scientific and Methodological Board of the University;

4) introduction of a questioning system on higher education quality for postgraduate students;

5) ratings of academic staff on performance indicators according to the license conditions for the educational activity realization;

6) control of higher education quality during the annual reports of the departments.

The control is carried out in accordance with the «Regulation on adoption and monitoring of departments ability to establish and implement educational activities in respect to license conditions», which is approved by the Academic Board of State Higher Education Institution «NMU».

The purpose of self-assessment of departments activities is to:

- ♦ prepare for the educational activity realization on the new speciality, another level of higher education and an increase in the licensed volume;
- ♦ monitor higher education quality level in the implementation of educational activity.

Analysis of self-assessment reports and the development of proposals to improve the quality of higher education are carried out by a regular working group on quality, which was created by the Rector's order #4 «About the system of internal quality assurance of higher education» of 27.01.2016;

7) Rector's control is systematically carried out in order to monitor the implementation of competence-based approach, teaching quality, ensuring the objectivity of measurement and evaluation of the academic achievements for higher education applicants. Rector's control may be carried out during the control activities in any discipline and mode of education;

8) Deans' reporting at the meetings of the University administration or University Academic Board about the tasks implementation and indicators achievement of higher education quality assurance, which regulate the planned absolute performance indicators in accordance with the NMU Development Programme;

9) reporting of Pro-Rector on Academic, Pedagogical, Educational work and Perspective Development to NMU Academic Board about the state of implementation by university departments of the NMU Development Programme component «Establishment of a quality assurance system in higher education»;

10) participation in national and international rating systems of higher educational institutions and making managerial decisions on the basis of rating results.

The internal quality assurance system is assessed by the National Agency for Quality Assurance in Higher Education or its accredited independent institutions of higher education quality assessment and assurance for compliance with applicable requirements.

## **6. Final provisions**

The educational programme is published on the university's website prior to applicants' admission to study.

The educational programme for Masters' training in System Analysis provides the quality of higher education at the design stage thanks to:

- 1) definition of the activity object, set of methods and working tools;
- 2) formation of a list of basic, professional and selective disciplines in the speciality;
- 3) definition of information systems and technologies to be studied;
- 4) use of programme results of teaching in accordance with higher education standards as requirements to the level of formation and complexity of professional master's competences, which can be identified, quantified and measured;
- 5) distribution of teaching results in the programme for all forms of the educational process organization and training sessions types, eliminating the educational material duplication;
- 6) identifying learning outcomes in the work programmes of educational disciplines, practices, individual tasks through specification of programme learning outcomes, which are used as criteria for selecting the necessary content modules.

Courses that ensure the acquisition of special competences are assigned to a selective component of the educational programme.

The cycle of professional training in the speciality ensures the acquisition by the applicant of educational and professional qualifications.

The educational programme provides an opportunity for a student to choose his own educational path by selecting an educational programme when entering, and using the opportunity in addition to master the elective disciplines.

The Head of the graduating department in the speciality is responsible for the educational programmes implementation and quality assurance of higher education.

## APPENDIX 3.1

THE PLAN OF EDUCATIONAL PROCESS OF MASTERS IN THE FIELD OF KNOWLEDGE Information Technologies FOR SPECIALTY 124 System Analysis (Master's)																																
Faculty: Information Technologies			2017-2018 academic year										1-st year (master's degree)																			
year of admission 2017			Specialization: "System Analysis and control"																													
№	subject	Chair	The volume of subject (time for assimilation)				Control is the final, quarter		Auditory load					Independence work		1st year (master), hours per week																
																1st semester								2nd semester								
			hours						credits				weeks				weeks				weeks				weeks							
			6		1		5		1		8		1			9		1														
			general	annual	National	ECTS	Exams	credit	Total	together	lectures	laboratory practical / seminar	Checking in	Total	part	lectures	laboratory	practical / seminars	Control measures	lectures	laboratory	practical / seminars	Control measures	lectures	laboratory	practical / seminars	Control measures	lectures	laboratory	practical / seminars	Control measures	
1. NORMATIVE PART																																
1.1 General training cycle																																
1	Foreign language for professional activities (English / German / French)	Foreign languages	180	180	4	6		2,4	96	84			84	12	84	0,47			3	3			3	3			3	3			3	3
2	Higher School Pedagogy	Fundamentals of designing mechanisms and machines	90	90	2	3		3	27	24	24			3	63	0,7							3			3						
3	Philosophical Issues of Scientific Research	Philosophy and pedagogy	90	90	2	3		3	27	24	16		8	3	63	0,7							2		1	3						
Total for the normative part:				360	8	12			150	132	40	0	92	18	210																	
2. Disciplines of specialization																																
1	Methodology of Scientific Research	System Analysis and Control	90	90	2	3		2	26	22	22			4	64	0,71	2			2	2			2								
2	Economic diagnostics of entrepreneurial activity	Applied Economics	120	120	2,7	4	2		52	44	22		22	8	68	0,57	2		2	4	2		2	4								
3	Intellectual Data Analysis	System Analysis and Control	180	180	4	6	2		52	44	22	22		8	128	0,71	2	2		4	2	2		4								
4	Basics of Logistics	System Analysis and Control	150	150	3,3	5	4		57	51	34	17		6	93	0,62							2	1		3	2	1			3	
5	Complex Systems Self-learning	System Analysis and Control	180	180	4	6	3		54	48	24	24		6	126	0,7							3	3		6						
6	Discrete optimization methods	System Analysis and Control	180	180	4	6		2	52	44	22	22		8	128	0,71	2	2		4	2	2		4								
7	Economic Support of Engineering Solutions	System Analysis and Control	180	180	4	6		2	39	33	22	11		6	141	0,78	2	1		3	2	1		3								
8	Integrated control systems	System Analysis and Control	90	90	2	3		3	36	32	16		16	4	54	0,6							2		2	4						
9	Mathematical modeling and analysis of dynamic systems	System Analysis and Control	180	180	4	6		4	60	54	27	27		6	120	0,67												3	3			6
10	Analysis and planning of the business environment market	Applied Economics	90	90	2	3		4	40	36	18		18	4	50	0,56												2		2		4
Total for the disciplines of specialization:				1440	32	48			468	408	229	123	56	60	972																	
Total :				1800	40	60			618	540	269	123	148	78	1182		20				20				22				16			
																	Exams 2						Exams 2									
																	Credits 4						Credits 6									

THE PLAN OF EDUCATIONAL PROCESS OF MASTERS IN THE FIELD OF KNOWLEDGE Information Technologies FOR SPECIALTY 124 System Analysis																							
Faculty: Information Technologies								2018-2019 academic year				2nd year (master's degree)											
year of admission 2017								Specialization: "System Analysis and control"															
№	subject	Chair	The volume of subject (time for assimilation)				Control is the final, quarter		Auditory load						Independe nt work		r (master), hours p						
			3 semester																				
			hours		credit		weeks																
			general	annual	National	ECTS	Exams	credit	Total	Training sessions				Checking in	Total	part	lectures	laboratory	practical / seminars	Control measures			
1. NORMATIVE PART																							
1.3 Practical training in specialty																							
1	Industrial Practical Training	System Analysis and Control	240	240	5,3	8		5							240	1							
2	Pre-Diploma Practical Training	System Analysis and Control	120	120	2,7	4		5							120	1							
3	Master Qualification Paper	System Analysis and Control	495	495	11	16,5		5							495	1							
4	Master Qualification Paper	Applied Economics	45	45	1	1,5		5							45	1							
Together :				900	20	30			0	0	0	0	0	0	900								
Total :				900	20	30			0	0	0	0	0	0	900	0							
																		Exams		0			
																		Credits		2			

## **APPENDIX 3.2**

### **List of Modules**

#### **Master program**

#### **“System analysis and control “**

### **Contents**

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List of Modules .....	99

### Course Guide Master Program (M.Sc.) „System analysis and control“-1

Semester								LP
9	Complex Sys- tems Self- Learning 6 LP	Project Man- agement 5 LP	Intellectual Data Analysis 6 LP	Enterprise Eco- nomical Activi- ty Analysis 4 LP	Methodology of Scientific Re- search 3 LP			24
10	Integrated Management Systems 7.5	Basics of Lo- gistics 6.5	Higher School Pedagogy  Intellectual Property  Labour Safety in the Branch  Philosophical Issues of Scien- tific Research 12			Game Theory in the Conflict Situation Stud- ies 5  Economic Sup- port of Engi- neering Solu- tions 5	Economic Sup- port of Engi- neering Solu- tions 5  Information Systems in Economy and Business 5	36
11	Industrial Prac- tical Training 6 LP	Pre-Diploma Practical Train- ing 3 LP	Master Thesis 21 LP					30
M.Sc.								90

## Course Guide Master Program (M.Sc.) „System analysis and control“

Course name		Numbers of hours	Numbers of credits	semester
Obligatory modules				
	Higher School Pedagogy	90	3	10
	Intellectual Property	90	3	10
	Labor Safety in the Branch	90	3	10
	Methodology of Scientific Research	90	3	9
	Philosophical Issues of Scientific Research	90	3	10
	Industrial Practical Training	180	6	11
	Pre-Diploma Practical Training	90	3	11
	Master Thesis	630	21	11
Special courses				
	Enterprise Economic Activity Analysis	120	4	9
	Complex Systems Self-Learning	180	6	9
	Integrated Management Systems	225	7.5	10
	Basics of Logistics	195	6.5	10
	Project Management	150	5	9
	Intellectual Data Analysis	180	6	9
Var. 2				
	Economic Support of Engineering Solutions	150	5	10
	Game Theory in the Conflict Situation Studies	150	5	10
Var. 1				
	Economic Support of Engineering Solutions	150	5	10
	Information Systems in Economy and Business	150	5	10

## Optional Compulsory Section of System Analysis

### List of Modules

№	Modul Name	Credit point
Project and System Management		
8	Project Management	5
9	Integrated Management Systems	7.5
10	Analysis of business activities of enterprise	5
11	Basis of Logistics	6.5
12	Mathematic Modelling and Analysis Dynamic System	5
15	Economic Support of Engineering Solutions	5
16	Information Systems in Economy and Business	5
“Computer based Methods”		
13	Computer network administration	5
7	Methodology of Scientific Research	3

<b>Industrial Practical Training</b>				
<b>1</b>	<b>Workload</b>	<b>Credit points</b> 6 LP	<b>semester</b> 11	<b>Duration</b>
<b>1</b>	<b>Courses</b>	<b>Contact time</b>	<b>Self-study</b>	<b>Credit points</b>
<b>2</b>	<b>Teaching form</b> Practical work			
<b>3</b>	<b>Group size</b> alone or in small group (1-3)			
<b>4</b>	<b>Qualification targets / skills</b> <ul style="list-style-type: none"> <li>the ability to apply knowledge gained in the study of disciplines of basic and variable part for applications;</li> <li>the ability to develop mathematical models for economic applications;</li> <li>ability to carry out the analysis and processing of statistical data;</li> <li>the ability to use numerical (approximate) methods for solving applied mathematical and economic problems and assess their accuracy and efficiency.</li> </ul>			
<b>5</b>	<b>Contents</b> <ul style="list-style-type: none"> <li>to familiarize students with basic kinds and objectives of future professional activity;</li> <li>to apply their learning at the theoretical and practical knowledge into practice;</li> <li>to promote knowledge level of students with the use of mathematical disciplines in the mathematical modeling of processes in the sphere of professional activity of the enterprise or organization;</li> <li>broaden the students' hands-on professional work sites.</li> </ul>			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written report Oral presentation			
<b>9</b>	<b>Requirement for Credit points</b> Participation in the practical work on a steady basis Passing the report Passing the oral exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 6/90			
<b>11</b>	<b>Frequency of Course</b> annually			
<b>12</b>	<b>Module Coordinator and Lecturer</b> individual tutor for each student			
<b>13</b>	<b>Further information</b> Compulsory Modul			

<b>Pre-Diploma Practical Training</b>				
<b>2</b>	<b>Workload</b>	<b>Credit points</b> <b>3</b>	<b>Semester</b> <b>11</b>	<b>Duration</b>
<b>1</b>	<b>Courses</b>	<b>Contact time</b>	<b>Self-study</b>	<b>Credit points</b>
<b>2</b>	<b>Teaching form</b> practical work			
<b>3</b>	<b>Group size</b> alone or small group (1-3)			
<b>4</b>	<b>Qualification targets / skills</b> <ul style="list-style-type: none"> <li>the ability to apply knowledge gained in the study of masters' program for practical applications or research;</li> <li>the ability to make mathematical models for applications to technological processes;</li> <li>the ability to carry out the analysis and processing of statistical data to solve problems of economic dynamics and forecasting, optimization;</li> <li>the ability to analyze complex processes and systems, mathematical modelling, or simulation of this processes and process management in complex systems and decision making.</li> <li>the ability to use numerical (approximate) methods for solving applied mathematical economic problems and assess their accuracy and efficiency.</li> </ul>			
<b>5</b>	<b>Contents</b> <ul style="list-style-type: none"> <li>data collection for master thesis;</li> <li>to apply their theoretical and practical skills into practice;</li> <li>to promote knowledge level of students with the use of mathematical disciplines in the mathematical modeling of processes in the sphere of professional activity of the enterprise or organization;</li> <li>broaden the students' hands-on professional work sites.</li> </ul>			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written report Oral presentation			
<b>9</b>	<b>Requirement for Credit points</b> Participation in the practical work on a steady basis Passing the report Passing the oral exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 3/90			
<b>11</b>	<b>Frequency of Course</b> annually			
<b>12</b>	<b>Module Coordinator and Lecturer</b> individual tutor for each student			
<b>13</b>	<b>Further information</b> Compulsory Modul			

Master thesis final oral exam				
<b>3</b>	<b>Workload</b>	<b>Credit points</b> 21 LP	<b>semester</b> 11	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b>	<b>Contact time</b>	<b>Self-study</b>	<b>Credit points</b>
<b>2</b>	<b>Teaching form</b> 1. Independent production of master thesis 2. Oral final exam			
<b>3</b>	<b>Group size</b> alone or in small group (1-3)			
<b>4</b>	<b>Qualification targets / skills</b> Implementation and defense of the thesis are the final stage of training that gives the right to educational and qualification level 'master'. Master thesis is a scientific research, conducted under the guidance of leading specialists. Thesis - the most important form of the self-study, during which a student acquires skills of organization and research. It reflects the general and professional maturity of the graduate, his ability to think dialectically and creatively and apply his knowledge in the solving of certain practical problems of system analysis for complex processes and systems, mathematical modeling, or simulation of this processes and process management in complex systems and decision making. The candidate must be able to clearly identify the object and the objective of the study, the purpose and the specific scientific and practical research problem and make a plan of work; to choose necessary methods and means for solving scientific and practical problems using modern information technology and automation research; to make bibliographic references on the topic of the thesis; to draw conclusions of the results obtained on the basis of generally accepted requirements for their design, using modern means.			
<b>5</b>	<b>Contents</b> The work can be: 1. experimental (independent student research, study and assimilation of techniques, development programs, etc.); 2. theoretical (student conducts theoretical research and practical experience studies); 3. theoretical and practical (student conducts theoretical research whose results are later applied in practice).			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Master Thesis Oral exam			
<b>9</b>	<b>Requirement for Credit points</b> Passing Master thesis Passing the oral exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 24/90			
<b>11</b>	<b>Frequency of Course</b> annually			
<b>12</b>	<b>Module Coordinator and Lecturer</b> individual tutor for each students			
<b>13</b>	<b>Further information</b> Compulsory Modul			

<b>Game Theory in the Conflict Situation Studies</b>				
<b>4</b>	<b>Workload</b> <b>150</b>	<b>Credit points</b> 5 LP	<b>semester</b> 10	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>32</b> <b>32</b>	<b>Self-study</b> <b>43</b> <b>43</b>	<b>Credit points</b> <b>2,5</b> <b>2,5</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The main purpose of the course is to study the basic game-theoretical models of conflicts and principles for solving them, get necessary skills to handle the acquired knowledge and use it mastering other subjects and in future careers.			
<b>5</b>	<b>Contents</b> The course includes the following issues and chapters: <ul style="list-style-type: none"> <li>– The conflict.</li> <li>– Modeling of a conflict and corresponding games.</li> <li>– Games classification.</li> <li>– Optimality principles.</li> <li>– Games in the traditional form.</li> <li>– Billing map and billing set.</li> <li>– Antagonistic games.</li> <li>– Games with strict and weak rivalry.</li> <li>– Prudence principle for antagonistic games, protective strategies.</li> <li>– Equilibrium principle for antagonistic games, equilibrium pair of strategies.</li> <li>– Optimal solutions for antagonistic games.</li> <li>– Mixed expansions for antagonistic games. Solving antagonistic games in mixed strategies.</li> <li>– Games in positional form.</li> <li>– Information set.</li> <li>– Games with the complete information.</li> <li>– Reduction of positional games to the games in traditional form.</li> <li>– Collective rationality: Pareto-optimal solutions.</li> <li>– Individual - rational solutions. Negotiation set. Nash non-cooperative equilibrium, Pareto equilibrium.</li> <li>– Competitive games.</li> <li>– Structured games.</li> <li>– Cooperative games. Partitions into cooperative games and their dominance.</li> </ul> C-core of cooperative games. Shapley vector. N-nucleus.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b> Optimization, Computer calculation			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			

<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam
<b>10</b>	<b>Percentage of grade in final mark</b> 5/90
<b>11</b>	<b>Frequency of Course</b> irregularly
<b>12</b>	<b>Module Coordinator and Lecturer</b>
<b>13</b>	<b>Further information</b> Optional Compulsory Modul

Machine Learning of Complex Systems				
<b>5</b>	<b>Workload</b> 180	<b>Credit points</b> 6 LP	<b>semester</b> 9	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>26</b> <b>26</b>	<b>Self-study</b> <b>64</b> <b>64</b>	<b>Credit points</b> <b>3</b> <b>3</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The module purpose is knowledge acquisition for the neural network structure and functions and the algorithms for their learning. The methods of complex systems self-organizing, methods of evolutionary modeling, programming and optimization based on evolutionary paradigms are also part of the training module.			
<b>5</b>	<b>Contents</b> Modules materials contents: 1) The structure of neural networks with different architectures and different activation functions; 2) The methods of teaching, testing and validation of neural networks of different types, comparing them with each other; 3) The group method of data handling and its using for complex functions approximation; 4) The evolutionary, genetic, mimetic and other based on wildlife analogies algorithms for solving problems of modeling, optimization and control in dimensional real space or binary space.			
<b>6</b>	<b>Usability of module for other programs</b> Computing calculation, programming			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 6/90			
<b>11</b>	<b>Frequency of Course</b> annually			
<b>12</b>	<b>Module Coordinator and Lecturer</b> individual tutor for each student			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

<b>Data Mining</b>				
<b>6</b>	<b>Workload</b> <b>180</b>	<b>Credit points</b> 6 LP	<b>semester</b> 9	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>26</b> <b>26</b>	<b>Self-study</b> <b>64</b> <b>64</b>	<b>Credit points</b> <b>3</b> <b>3</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The main purpose of the course is to introduce modern systems and methods for data analysis and receive skills of their use for solving applied problems. The module purpose is recognition and identification of hidden structures, patterns, or relationships in "raw data". This patterns or structures must be not previously known, not trivial, practically useful, accessible to human interpretation and necessary for decision-making in different areas. The algorithms of artificial intelligence for data analysis are also part of the training module. Students acquire necessary skills of using the statistical software packages (SPSS, statistica, STADIA, STAT-GRAPICS) for analytical calculations			
<b>5</b>	<b>Contents</b> The objects of the study are: - Information preprocessing techniques, - Factor analysis algorithms, - Classification and clustering methods, - Decision trees algorithms, - Associative rules and sequential patterns recognition, - Bayesian networks method. The machine learning technique for knowledge-based intelligent decision support systems is studied. The theoretical part of the course deals with notions of data and ways of data representation and visualization, traditional technologies of data analysis: deterministic and probabilistic; concepts and tasks of data mining with application of new knowledge are considered. We consider the following approaches to data analysis: genetic algorithms, their use for evolutionary calculations, optimization problems and combinatorial problems; artificial neural networks and their architecture, principles of construction, processes of learning and problem solving; Data Mining systems, their construction, classification, and application; the decision tree and its characteristics; DM application for clustering, data filtering and other components of the decision tree.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			

<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam
<b>10</b>	<b>Percentage of grade in final mark</b> 6/90
<b>11</b>	<b>Frequency of Course</b> annually
<b>12</b>	<b>Module Coordinator and Lecturer</b>
<b>13</b>	<b>Further information</b> Optional Compulsory Modul

Methodology of Scientific Research				
<b>7</b>	<b>Workload</b> <b>90</b>	<b>Credit points</b> 3 LP	<b>semester</b> 9	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures	<b>Contact time</b> <b>39</b>	<b>Self-study</b> <b>41</b>	<b>Credit points</b> <b>3</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch			
<b>3</b>	<b>Group size</b> Lecture 60			
<b>4</b>	<b>Qualification targets / skills</b> The main purpose of the course is to study methods of preparation, planning and conducting experiments, processing the results of these experiments in the form of statistical, graphical, and mathematical analysis; to arrange and submit the results of scientific work.			
<b>5</b>	<b>Contents</b> The matter of the course: in the theoretical part one can be taught about foundations of the planning theory for single valued and multi-valued experiments, methods of factors consideration and construction of optimal plans of experiments, increasing accuracy and informative value of obtained results. Basic logical and statistical methods, accuracy evaluation criteria of the experiments and significance of the obtained data (balance equation, recrudescence measurements, Pearson's, Student's, Fisher's criteria) are considered here. We practiced the methods of graphical and mathematical analysis of experimental results (least squares method, extrapolation, interpolation, Lagrange method, Askovits method, variables replacement). Special attention is paid to organization of wording skills, testing and publication of research results, processing of various kinds of scientific work (articles, abstracts, monography, thesis). We expound the requirements to scientific works to be submitted for the degree and qualification level, and, moreover, we consider the processes of maintenance of such works.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			
<b>9</b>	<b>Requirement for Credit points</b> Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 3/90			
<b>11</b>	<b>Frequency of Course</b> annually			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

Project Management				
<b>8</b>	<b>Workload</b> <b>150</b>	<b>Credit points</b> 5 LP	<b>semester</b> 11	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>26</b> <b>26</b>	<b>Self-study</b> <b>49</b> <b>49</b>	<b>Credit points</b> <b>2,5</b> <b>2,5</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15)			
<b>4</b>	<b>Qualification targets / skills</b> Students receive basic knowledge which is concerned with project management and skills to use technologies applied in project management.			
<b>5</b>	<b>Contents</b> Theoretical part of the course includes consideration of project management in modern conditions, project life cycle, its studies, directing marks and resources. The project definition is described. Evolution of project management systems is analyzed. Priorities are arranged as well as structuring of suitable works in proper stages. We consider modern methods of project managing and characteristic features of marketing projects, skills in operating and economic planning with usage of applications such as MS Project. During the laboratory works students study <ul style="list-style-type: none"> <li>- Gant's table diagrams;</li> <li>- network diagram of project planning;</li> <li>- work options definition, different work types, work schedule;</li> <li>- critical path notion;</li> <li>- resource management;</li> <li>- distribution of resources by works and ranging/leveling resource loading;</li> <li>- planning of project cost, description of resource cost, describing of project cost;</li> <li>- project monitoring and management;</li> <li>- providing the control of the project implementation;</li> <li>- estimated and real project characteristics;</li> <li>- project time management;</li> <li>- monitoring deviations from a basic plan;</li> <li>- control and regulation of labor costs;</li> <li>- budget execution analysis;</li> <li>- resource sharing and project conjunction;</li> <li>- control of work execution;</li> <li>- planning of balanced loading of projectors;</li> <li>- redirection of projectors;</li> <li>- projects consolidation;</li> <li>- reports on projects in MS Project, project statistics review;</li> </ul> Types of text reports/logs, report editing.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			

<b>8</b>	<b>Method of examination</b> Written exam (60 min)
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam
<b>10</b>	<b>Percentage of grade in final mark</b> 5/90
<b>11</b>	<b>Frequency of Course</b> annually
<b>12</b>	<b>Module Coordinator and Lecturer</b> individual tutor for each student
<b>13</b>	<b>Further information</b> Optional Compulsory Modul

<b>Integrated Management Systems</b>				
<b>9</b>	<b>Workload</b> 225	<b>Credit points</b> 7,5 LP	<b>semester</b> 10	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> 32 32	<b>Self-study</b> 88 73	<b>Credit points</b> 4 3,5
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The main purpose of the course is to introduce the requirement for Integrated Management system, their special characters and structure, methods of design and optimization.			
<b>5</b>	<b>Contents</b> In the theoretical part of the course we consider <ul style="list-style-type: none"> <li>- The requirements for MIS.</li> <li>- The tasks which have systematic character in MIS.</li> <li>- The structure and purpose of the elements of MIS.</li> <li>- Program-technical block of MIS.</li> <li>- Structural principles of MIS.</li> <li>- Design procedure of MIS.</li> <li>- Economic efficiency of MIS.</li> <li>- Complex data types.</li> <li>- Two-dimensional arrays.</li> <li>- Algorithmizing and methods for solving the problem of materials cutting.</li> <li>- Algorithmizing and methods for solving the problem of processing line.</li> <li>- Algorithms for the events recognition.</li> </ul>			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b> Optimization			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 7,5/90			
<b>11</b>	<b>Frequency of Course</b> annually			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

<b>Analysis of business activities of enterprise</b>				
<b>10</b>	<b>Workload</b> <b>120</b>	<b>Credit points</b> 4	<b>semester</b> 9	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>28</b> <b>28</b>	<b>Self-study</b> <b>32</b> <b>32</b>	<b>Credit points</b> <b>2</b> <b>2</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The main purpose of the course is to develop an integrated system of knowledge for students for carrying-out of an economic analysis and evaluation of the organization (enterprise) activity, identifying internal economic reserves, justification of optimal management decisions.			
<b>5</b>	<b>Contents</b> The mastering of discipline involves the study of the basic principles and methodological approaches to business analysis, traditional methods of economic information processing, methods of measuring the impact of factors in deterministic analysis and methodological approaches to identify and count of reserves for efficiency increasing. As a result of the course study, students acquire skills of application of methods and tools of integrated assessment of the organization (enterprise) as well as the processing of economic activities analysis in the organization (enterprise), taking into account internal and external environment and industry of the functioning.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 4/90			
<b>11</b>	<b>Frequency of Course</b> annually			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

Basics of Logistics				
<b>11</b>	<b>Workload</b> <b>195</b>	<b>Credit points</b> 6,5 LP	<b>semester</b> 10	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>32</b> <b>32</b>	<b>Self-study</b> <b>105</b> <b>58</b>	<b>Credit points</b> <b>3.5</b> <b>3</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b>			
<b>5</b>	<b>Contents</b> The conceptual frameworks and methodological apparatus of logistics, planning and management methods for production and economic systems are examined. The classification and structuring of logistics systems are studied. The methods of system analysis and logistics systems simulation are defined. The management methods of order, procurement and inventory are mastered. Range of problems is formulated and the methods of their implementation in the production, storage and transport logistics are defined. Range of logistics activities and their composite elementary operations has its definition and characterization. Necessary information support for efficient logistics process is considered. During the laboratory works students acquire necessary skills for overall cost analysis during making different decisions in logistics. The methods for control of goods supply and the method for using such control results to decide whether to extend the contract with the current supplier are reviewed. The method of turnover calculation (including minimal) and acquaintance with different estimation methods of the warehouse location distribution are studied. The skills in planning of material requirements and optimization of the stock product are obtained.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b> Optimization			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in cours 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 6,5/90			
<b>11</b>	<b>Frequency of Course</b> annualy			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

<b>Mathematic Modelling and Analysis Dynamic System</b>				
<b>12</b>	<b>Workload</b> <b>180</b>	<b>Credit points</b> 6	<b>semester</b> 10	<b>Duration</b> 1 semester
<b>1</b>	<b>Courses</b> course 1 lectures cours 2 exercises	<b>Contact time</b> <b>32</b> <b>32</b>	<b>Self-study</b> <b>58</b> <b>58</b>	<b>Credit points</b> <b>3</b> <b>3</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> Course objective - to master knowledge and skills to use mathematical methods to study structure and dynamic mathematical models and control systems of the modern theory of dynamical systems modeling using computer technology. After of the course students will take the ability to: <ul style="list-style-type: none"> <li>• build mathematical models of dynamic systems according to field observations based on the laws of conservation;</li> <li>• build mathematical models for optimal conditions of incomplete data;</li> <li>• build mathematical models of complex dynamical managed interacting systems and processes.</li> </ul>			
<b>5</b>	<b>Contents</b> The course includes the following issues and chapters: <ul style="list-style-type: none"> <li>• the basic methods of mathematical modeling of dynamic systems and optimal control systems;</li> <li>• methods of targeted analysis of controlled dynamic systems and processes;</li> <li>• the methods of forecasting dynamic systems and managed processes;</li> <li>• the methods for constructing optimal models of dynamic systems in real conditions in the presence of incomplete data and incomplete knowledge;</li> </ul>			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b> To study the discipline necessary knowledge of mathematical analysis, linear algebra and analytical geometry, differential equations, differential equations in partial derivatives, optimization methods and operations research.			
<b>8</b>	<b>Method of examination</b> Written exam (60 min) Types of controlling current knowledge - check individual tasks and tasks for independent work. Type of control additional knowledge - tests.			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 6/90			
<b>11</b>	<b>Frequency of Course</b> irregularly			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

<b>Computer Network Administration</b>				
<b>13</b>	<b>Workload</b> <b>90</b>	<b>Credit points</b> <b>3</b>	<b>semester</b> <b>10</b>	<b>Duration</b> <b>1 semester</b>
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>16</b> <b>16</b>	<b>Self-study</b> <b>29</b> <b>29</b>	<b>Credit points</b> <b>1,5</b> <b>1,5</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 1 ch 2. Exercises 1 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The main purpose of the course is the study of typical problems faced by system administrators as well as acquisition of skills, knowledge and diagnostic tools needed for design, installation, and adjustment of computer networks.			
<b>5</b>	<b>Contents</b> In the theoretical part of the course the following question are considered: <ul style="list-style-type: none"> <li>- The main requirements in the design of computer networks.</li> <li>- Essential tools for computer network installation and diagnostics of common problems in signal transmission.</li> <li>- Structured cabling systems. The composition, architecture, and classes SCS.</li> <li>- Server. Typical roles on Windows Server example.</li> <li>- The types of threats for computer networks and basic tools to prevent them.</li> </ul> The problems of computer network simulation, server operating systems installation and configuration, network traffic monitoring and analyzing are solved during the laboratory works.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 3/90			
<b>11</b>	<b>Frequency of Course</b> irregularly			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

<b>Discrete Optimization</b>				
<b>14</b>	<b>Workload</b> <b>150</b>	<b>Credit points</b> <b>5</b>	<b>semester</b> <b>10</b>	<b>Duration</b> <b>1 semester</b>
<b>1</b>	<b>Courses</b> course 1 lectures course 2 exercises	<b>Contact time</b> <b>28</b> <b>28</b>	<b>Self-study</b> <b>37</b> <b>37</b>	<b>Credit points</b> <b>2.5</b> <b>2.5</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The main purpose of the course is the study of the main methods of discrete optimization, acquisition of operating skills knowledge and their use for the study of other subjects and in their future careers.			
<b>5</b>	<b>Contents</b> Discrete optimization problems. Complexity classes P and NP; NP-completeness proofs. Local search methods. Threshold algorithms. The method of branches and boundaries. Solving the problem of traveling salesman branch and bound method. The method of dynamic programming for solving of a backpack problem. Homory method for solving the problem of integer linear programming. The assignment problem. Hungarian method. Approximate algorithms for solving discrete optimization problems with accuracy estimate. Approximate solution of "best average". Effective exponential area for assignment problem, traveling salesman problem, quadratic assignment problem.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b>			
<b>8</b>	<b>Method of examination</b> Written exam (60 min)			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 5/90			
<b>11</b>	<b>Frequency of Course</b> irregularly			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

<b>Information systems in economy and business</b>				
<b>15</b>	<b>Workload</b> <b>180</b>	<b>Credit points</b> <b>5</b>	<b>semester</b> <b>10</b>	<b>Duration</b> <b>1 semester</b>
<b>1</b>	<b>Courses</b> course 1 lectures cours 2 exercises	<b>Contact time</b> <b>32</b> <b>32</b>	<b>Self-study</b> <b>58</b> <b>58</b>	<b>Credit points</b> <b>3</b> <b>3</b>
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch			
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15			
<b>4</b>	<b>Qualification targets / skills</b> The main goal of discipline is to develop in students an integrated system of knowledge on the basics of creation and operation of information systems, its role in economic management and business processes. As a result of the course students gain skills in the use of modern information technologies for functional business management; using of systematic approach in the development of automated solutions for solving of business management problems.			
<b>5</b>	<b>Contents</b> Mastery of the discipline involves the study of the main provisions of the scientific management of information systems in the economy based on modern technology, software, tools and communication tools for its creation and development.			
<b>6</b>	<b>Usability of module for other programs</b>			
<b>7</b>	<b>Prerequisites for participation</b> To study the discipline necessary knowledge of mathematical analysis, linear algebra and analytical geometry, differential equations, differential equations in partial derivatives, optimization methods and operations research.			
<b>8</b>	<b>Method of examination</b> Written exam (60 min) Types of controlling current knowledge - check individual tasks and tasks for independent work. Type of control additional knowledge - tests.			
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam			
<b>10</b>	<b>Percentage of grade in final mark</b> 5/90			
<b>11</b>	<b>Frequency of Course</b> irregularly			
<b>12</b>	<b>Module Coordinator and Lecturer</b>			
<b>13</b>	<b>Further information</b> Optional Compulsory Modul			

<b>Economic Support of Engineering Solutions</b>					Economic provision for the engineering decisions
<b>16</b>	<b>Workload</b> <b>180</b>	<b>Credit points</b> <b>5</b>	<b>semester</b> <b>10</b>	<b>Duration</b> <b>1 semester</b>	
<b>1</b>	<b>Courses</b> course 1 lectures cours 2 exercises	<b>Contact time</b> <b>32</b> <b>32</b>	<b>Self-study</b> <b>58</b> <b>58</b>	<b>Credit points</b> <b>3</b> <b>3</b>	
<b>2</b>	<b>Teaching form</b> 1. Lectures 2 ch 2. Exercises 2 ch				
<b>3</b>	<b>Group size</b> Lecture 30 exercises 15				
<b>4</b>	<b>Qualification targets / skills</b> The main goal of discipline is to develop the students' knowledge of integrated system of economic substantiation of expediency adoption of engineering decisions that have the technical, technological, environmental, social and other consequences. As a result of the course students gain skills in business plan development and application of modern methods of evaluating the effectiveness of engineering decisions in technical, technological, organizational, environmental and social areas, taking into account changes in the business environment.				
<b>5</b>	<b>Contents</b> Mastering the discipline involves the study of the basic principles mechanisms and methodological approaches to justification for the economic efficiency of engineering solutions.				
<b>6</b>	<b>Usability of module for other programs</b>				
<b>7</b>	<b>Prerequisites for participation</b> To study the discipline necessary knowledge of mathematical analysis, linear algebra and analytical geometry, differential equations, differential equations in partial derivatives, optimization methods and operations research.				
<b>8</b>	<b>Method of examination</b> Written exam (60 min) Types of controlling current knowledge - check individual tasks and tasks for independent work. Type of control additional knowledge - tests.				
<b>9</b>	<b>Requirement for Credit points</b> Regular participation in course 2 Passing the written exam				
<b>10</b>	<b>Percentage of grade in final mark</b> 5/90				
<b>11</b>	<b>Frequency of Course</b> irregularly				
<b>12</b>	<b>Module Coordinator and Lecturer</b>				
<b>13</b>	<b>Further information</b> Optional Compulsory Modul				

## Compulsory Modules of pedagogical and research discipline

### List of Modules

№	Modul Name	Credit point
1	Higher School Pedagogy	3
2	Intellectual property law	3
3	Labor Safety in the Branch	3
4	Philosophical Issues of Scientific Research	3

### Higher School Pedagogy

**The purpose of discipline** is to disclose the object components of activities of the lecturer in the primary positions - technology of design normative and educational documents of pedagogical process modeling, technology of its implementation, organization and management technologies within definite powers.

**During the course** students learn

- The state of higher education in Ukraine;
- The formation of educational training programs for job seekers;
- The formation program of the discipline;
- Requirements for discipline diagnostic, for complex tasks and qualifying activities;
- Components of the educational process and requirements for them;
- Learning technologies and their constituents
- The requirements of European integration processes for the design and implementation of the educational process

### Intellectual property law

**Purpose:** in-depth study of legal intellectual property, acquiring legal mechanism for their regulation, obtaining the necessary skills training results of creative activity, protection of property and moral rights of authors in Ukraine, features the use and transfer of intellectual property rights, as well as for government agencies and law enforcement bodies of Ukraine measures to protect intellectual property rights.

**Subject:** intellectual property system and its components (objects and subjects of intellectual property, state property management system, the legislation of Ukraine

and international treaties that define intellectual property rights, regulating the safety and protection of these rights, and the use and transfer (commercialization) intellectual property rights). The practice of application of national legislation and international agreements on intellectual property.

**Content Modules:** The concept of intellectual property rights. Intellectual property system and its components. Legal protection of intellectual property. Copyright and Related Rights. Patent law. Means of individualization of participants of civil turnover of goods and services. Unconventional intellectual property rights. The use of intellectual property rights on a contractual basis. Protection of intellectual property. Economy of Intellectual Property.

### **Labor Safety in the Branch**

**The purpose** of the discipline is to form of skills and competencies for effective safety management and improving of working conditions based on scientific and technological progress and international experience. Students should understand of the indissoluble unity of successful professional activity with mandatory compliance all safety requirements work.

After finish the course students will be able to solve professional tasks considering the requirements of occupational health. They will possess such basic professional competence as:

- the readiness to use modern methods for research and analysis of risks, threats and hazards in the workplace and production facilities;
- the ability to put tasks and organize research to determine professional, occupational hazards, threats in the workplace.
- to take the participation in the investigation of accidents, accidents and occupational diseases;
- to develop and implement of measures to address the causes of accidents, in the aftermath of accidents at work.
- to implement of organizational and technical measures to improve working conditions;
- the ability and willingness to take account of the provisions of the laws and of regulations on health and safety in the performance of manufacturing and administrative functions;
- to manage actions to prevent the occurrence of accidents, occupational diseases and accidents at work;
- to implement of effective separation between the functions, duties and powers of health and safety in the workplace.

**The course includes the following issues and chapters:** legislation and regulations on health and safety in the industry; safety management; preventing workplace injuries and occupational diseases; monitoring of working conditions in the industry; electrical safety; fire security.

## APPENDIX 3.3

### AGREEMENT ON A DUAL DEGREE

#### BETWEEN

National Mining University, UKRAINE

#### AND

University of Koblenz-Landau, GERMANY

The National Mining University, Dmitry Yavornytsky avenue 19, 49005, Dnipro, UKRAINE, represented by its Rector, Prof. Dr. Gennadiy Pivnyak, and the University of Koblenz-Landau (Uni KO-LD), Rhabanusstraße 3, 55118 Mainz, GERMANY, represented by its President, Prof. Dr. Roman Heiligenthal, have decided to embark on an exchange of students that will culminate in the award of the degrees of both institutions under the conditions specified hereunder.

#### Article 1 Scope of the Agreement

This agreement applies to:

##### ➤ National Mining University students

- who are enrolled in the final year of the bachelor studies at the National Mining University (Ukraine) and qualify for the admission to the masters programme in "System Analysis and Control" in accordance with the Ukrainian admission regulations;
- have an overall grade of 2,3 (good) or better acc. to the German grading system;
- and have a good command of English language, which corresponds to B2 level.

##### ➤ Uni KO-LD students (Germans and other nationalities)

- who are matriculated (and have fulfilled the same entrance qualification as the applying National Mining University students) in the Master program "Mathematical Modeling of Complex Systems" at Uni KO-LD;
- are in their 2<sup>nd</sup> Semester of studies;
- and have a good command of Ukrainian language, which corresponds to B2 level.

It is agreed that up to 8 students of each university will be admitted into the Dual Degree program per year.

#### Article 2 Selection Procedures

The National Mining University students who have completed the three years of the bachelor degree have to apply for the Dual Master at the Uni KO-LD on a regular basis in the period from March to May 15th for the winter semester of the same year.

Uni KO-LD students also have to apply to the Master program in the period from May 15th to July 30th at the National Mining University after they have successfully completed the first semester of studies at Uni KO-LD.

#### Article 3 Organization of studies

Students of the National Mining University joining the hereunder signed dual degree agreement will study the 1st and 2nd semester of their Master program at the Uni KO-LD in Germany. During this period students have to collect approx. 60 credit points (CP) acc. to the European Credit Transfer System (ECTS) for modules. A list of selectable modules at Uni KO-LD is given in Annex 1 of this agreement.

Students from the Uni KO-LD joining the hereunder signed dual degree agreement will study 3<sup>rd</sup> and 4<sup>th</sup> semester of the Master program at the National Mining University in Ukraine. During this period students have to collect approx. 60 credit points acc. to the European Credit Transfer System (ECTS) for modules and a master's thesis. A list of selectable modules for the National Mining University is given in Annex 2 of this agreement.

At both universities a mentor will supervise the students going for the Dual Degree program and assist them in selecting the most suitable modules from Annex 1 and 2.

Each Master thesis will be supervised by two supervisors - by the main supervisor from the National Mining University and a second supervisor from the Uni KO-LD. The defense of a Master thesis will take place at the National Mining University.

A Uni KO-LD supervisor ideally should join the defense of the student's thesis at the National Mining University. If he/she is not able to attend, he/she has to write a short expertise on the Master thesis (approx. 1 page) which should include:

- the objectives of the thesis
- an assessment of up to which degree the student has fulfilled the expectation of the supervisor
- an indication of the main outcomes and benefits of the thesis
- an assessment on how much support was necessary to guide the student during his or her thesis
- a suggestion for the mark of the Master thesis acc. to the German grading system.

#### **Article 4 Acknowledgment of student achievements**

On the assumption of fundamental equivalence and based on mutual trust in the academic quality of the host university's curriculum it is agreed that the National Mining University acknowledges examination results of dual-degree students at the Uni KO-LD and that the Uni KO-LD acknowledges examination results of dual degree students at the National Mining University (see Annex 3).

For the purpose of recognition and transfer of national grades into the respective other system the partners agree on the credits and grades transfer system given in Annex 4.

All the results achieved at one university will be sent to the Registrar's Office of the other institution within 6 weeks of the end of the mobility phase as a transcript of records.

#### **Article 5 Assistance at a host institution**

The host institution will appoint a mentor from the Department for each student, to whom he/she may apply for advice or assistance during his/her stay in the host country. The mentors are responsible for the preparation of the individual study plans.

#### **Article 6 Examination and Study regulations**

During their studies at the Uni KO-LD, students will follow the current version of the examination and study regulations for the Dual Master program.

During their studies at the National Mining University, students will follow the current version of the examination and study regulations for the Master program "System Analysis and Control" of that university.

#### **Article 7 Degree**

On successful completion of the semesters at the Uni KO-LD and the semesters at the National Mining University (120 ECTS credits in Germany and 90 credits in Ukraine including the Master thesis) both universities will award the degree of "Master of Science".

In an appropriate manner both universities will state clearly in the relevant documents (diploma supplement, certificate, transcript of records) that the awarded degree is part of a Dual Degree Master Program between the Uni KO-LD and the National Mining University.

Every student will receive a certificate as well as their final transcript of records from the Uni KO-LD for the Master Program "Mathematical Modeling of Complex Systems" with an addition stating that the study program was conducted in cooperation with the Master Program "System Analysis and Control" at the National Mining University. Moreover, every student will receive a certificate as well as their final transcript of records from the National Mining University for the Master Program "System Analysis and Control" with an addition stating that the study program was conducted in cooperation with the Master Program "Mathematical Modeling of Complex Systems" at the Uni KO-LD.

Both transcripts of records will contain all credits and grades obtained at both institutions. It will be clearly marked which results were achieved at the Uni KO-LD and which ones at the National Mining University. All students will also receive a Diploma Supplement issued by the Uni KO-LD.

#### **Article 8 Financial and other arrangements**

Expenses for travel and accommodation must be covered by the student. The host institution will help the students obtain the same facilities foreseen for their own students.

It is a responsibility of the student to receive a visa for the respective host country. Neither the home nor the host university will cover visa fees. The host university will provide the student with an admission or an invitation letter necessary for obtaining a visa.

Due to German state legislation, all students taking part in the dual degree program must obtain German health insurance for the entire period of their studies. This insurance can be obtained upon arrival in Germany. It is highly advisable that each student also has insurance in Ukraine as well.

Students of the dual degree program will pay applicable administration fees to each institution only during their phase of attendance. No fees will be paid at the respective other institution while attending the host institution. No tuition fees will be charged by either of the institutions for the Dual Degree Program.

#### **Article 9 Monitoring of the Program**

The persons responsible for the Program at both institutions will meet at least once a year in order to:

- review the effectiveness of the teaching programs;
- examine the academic results achieved by the students in the light of the institutions' joint effort;
- propose further actions.

#### **Article 10 Scholarly exchange**

In order to promote joint actions in education and research, the National Mining University and the Uni KO-LD will encourage:

- exchanges of students, university staff and researchers;
- study sessions, workshops, and seminars on previously agreed subjects;
- exchange of information, documents and scientific publications;
- student exchanges involving work experience or visits to companies.

The exchange of persons shall comply with the regulations and procedures in force at the home institutions.

**Article 11 Efficacy and Interim Regulations**

This Agreement will come into force immediately after the signature of the responsible University Authorities.

It will be valid for five years, and will be automatically renewed for another five years provided that the previous activities have been positively evaluated and that the two parties agree on a renewal.

This agreement may be amended by the mutual consent of the parties hereto. Any party may withdraw from this agreement at any time. The agreement will be terminated 6 months after the date of the written notification of the withdrawal to the partner Institution. In such an event, all actions previously undertaken shall nevertheless be completed. It will be ensured that students already committed to the Dual Degree Program will receive the opportunity to complete the program in due form.

**Article 12 Disclaimer**

The signing of this agreement does not entail any financial obligation for the parties.

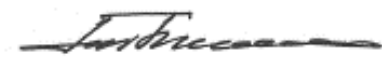
**Article 13 Miscellaneous**

The parties agree to solve in a friendly manner any controversy rising from the Interpretation of the present agreement.

In case an agreement cannot be achieved, the claim will be submitted for arbitration; each party will appoint a member of the arbitration panel, and one member will be chosen by mutual consent.

This agreement is valid in English only.

FOR THE  
NATIONAL MINING UNIVERSITY



Prof. Dr. Gennadiy Pivnyak  
Rector

Date



FOR THE  
UNIVERSITY OF KOBLENZ-LANDAU



Prof. Dr. Roman Heiligenthal  
President

Date

03.07.2017



**Annex 1: Modules to be taken at the University of Koblenz-Landau (Germany)**

Title <sup>1</sup>	ECTS
Applied Differential Equations	9
Physics in Applications	6
Optimization	9
Solid State Physics	6
Physics in Applications	6

**Annex 2: Modules to be taken at the National Mining University (Ukraine)**

Title <sup>2</sup>	ECTS
Enterprise Economical Activity Analysis	6
Basics of Logistics	6
Higher School Pedagogy	3
Intellectual Property	3
Methodology of Scientific Research	3
Philosophical Issues of Scientific Research	3

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<sup>1</sup> Any changes should be sent via e-mail beforehand

<sup>2</sup> Any changes should be sent via e-mail beforehand

**Annex 3: Module Recognition\***

<b>Modules and Study Units at the Uni KO-LD "Mathematical Modeling of Complex Systems"</b>	<b>Modules and Study Units at the National Mining University "System analyses and control"</b>
Project seminar	Industrial Practical Training
Project seminar	Pre-Diploma Practical Training
Master thesis final oral exam	Master thesis final oral exam
Special topics of Applied Mathematics	Game Theory in the Conflict Situation Studies
Numerics for Partial Differential Equations	Mathematic Modelling and Analysis Dynamic System
Integer Optimization	Methods of discrete optimization
Pattern Recognition	Machine Learning of Complex Systems
Machine Learning & Data Mining	Intellectual Data Analysis
Robotics and Computer Vision	Robotics and Computer Vision
Enterprise Architecture Modeling I	Enterprise Architecture Modeling

\* Module equivalents can be adjusted according to the current study offer. Adjustments have to be made in a written form per e-mail or per post.

**Annex 4: Transfer of Grades**

Examination Grades at the Uni KO-LD	Percentage at the Uni KO-LD	Percentage at the SSU	Examination Grades at the National Mining University
1,0	>95%-100%	90%-100%	5, A (excellent)
1,3	>90%-95%		
1,7	>85%-90%	82%-89%	4, B (good)
2,0	>80%-85%		
2,3	>75%-80%	74%-81%	4, C (good)
2,7	>70%-75%	64%-73%	3, D (satisfactory)
3,0	>65%-70%		
3,3	>60%-65%	60%-63%	3, E (satisfactory)
3,7	>55%-60%	35%-59%	2, FX (unsatisfactory)
4,0	>50%-55%		
5,0	failed	0%-34%	2, F (unsatisfactory)

**Annex 5: Transfer of Credits**

Credits at the Uni KO-LD (1 CP is equivalent to 30 work hours)	Credits at the National Mining University (1 CP is equivalent to 30 work hours)
1 CP	1 CP
2 CP	2 CP
3 CP	3 CP
4 CP	4 CP
5 CP	5 CP
6 CP	6 CP
7 CP	7 CP
8 CP	8 CP
9 CP	9 CP
10 CP	10 CP

## APPENDIX 3.4

UNIVERSITÄT  
KOBLENZ · LANDAU

ZENTRALE UNIVERSITÄTSVERWALTUNG

Universität Koblenz-Landau · Postfach 1054 · 55 008 Mainz

To Who mit May Concern

Präsidialamt  
Rhabanusstraße 3  
55118 Mainz

Internationale Zusammenarbeit

Bearbeiterin: Frau Dr. Shalaginova  
Telefon: 06131 37460-26  
Telefax: 06131 37460-40  
E-Mail: ishalaginova@uni-koblenz-landau.de

15. Februar 2018

**Subject: Admission as a Dual-Degree Student**

With this letter we confirm that Mr. Oleh Zinchenko, born on 19.11.1995, was accepted as a Dual Degree Student in the international master programme "Mathematical Modeling of Complex Systems.

With kind regards,

Dr. Iryna Shalaginova

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Telefax: 06341 280-31101

## APPENDIX 5.1

Ministry of Education and Science of Ukraine  
State Higher Educational Institution  
National Mining University

System Analysis and Control Department



**Novitskiy I.V.**  
**Koryashkina L.S.**

**WORKING PROGRAM OF EDUCATIONAL DISCIPLINE**  
**EC9 "Mathematical Modeling and Analysis of Dynamic Systems"**  
For masters of specialty 124 "System Analysis"

Dnipro  
NMU  
2017

Novitskiy I.V. The program of academic discipline VK9 «Mathematical modeling and analysis of dynamic systems» for masters of specialty 124 «System analysis» /

I.V. Novitskiy, L.S. Koryashkina; National Mining University, department of system analysis and control. - D.: NMU, 2017. - 13 p.

Considered and approved by the methodical commission on the specialty 124 "System Analysis" on the submission of the Department of System Analysis and Control

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## INTRODUCTION

The programmed results of the master's degree in system analysis are defined in the standard of higher education by specialty 124 System Analysis.

In the educational-professional program of the State Higher Educational Institution "NMU" [2.1] the distribution of programmatic learning outcomes was carried out according to the organizational forms of the educational process. The discipline "Mathematical modeling and analysis of dynamic systems" includes the following competencies and learning outcomes:

FK1 - Ability to develop and analyze mathematical models of natural, technological, economic and social facilities and processes;

FK2 - Ability to plan and conduct system studies, perform mathematical and information modeling of dynamic processes;

FK8 - Ability to develop a forecasting tool dynamics of processes of different nature in deterministic and stochastic environment and assess the quality of forecasts;

PRN3 Know the methods of forecasting the dynamics of processes of different nature, be able to develop prediction functions;

PR96 Know and be able to apply the methods of evolutionary modeling and genetic optimization methods, inductive modeling methods and mathematical apparatus of fuzzy logic, neural networks, game theory and distributed artificial intelligence, etc .;

RNS1 Know and be able to identify (estimate) the parameters of mathematical models of objects of management in real time with changes in its dynamics and the effects of random disturbances, using the measured signals of the input and output coordinates of the object;

RNS4 To analyze the stability of dynamic systems, to apply stochastic regression models and models in the state of space to describe the dynamics of processes of different nature.

In addition to the professional learning outcomes while studying the discipline, the bachelor must master the following general learning outcomes:

ZRN2 Be able to search information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources.

ZRN3 Be able to process, analyze, systematize scientific and technical information, generalize advanced national and foreign experience in system analysis.

ZRN4 To develop and apply in the professional activity their creative abilities, to organize a workplace, to plan working hours

ZRN5 Exercise curiosity, risk aversion, thinking skills, inspire new ideas, incarnate them, ignite them, combine and experiment

The purpose of the discipline "Mathematical modeling and analysis of dynamic systems" is the formation of future specialists in theoretical knowledge and practical skills of mathematical formalization of the behavior of systems of various nature, the ability to apply the theory of control, optimization in the analysis of dynamic systems.

Realization of the goal requires the transformation of the program results of training in discipline, and the selection of the content of the discipline according to this criterion.

Requirements for the structure of the work program of disciplines are given in [2.5].

## 1 FIELD OF USE

*The work program is designed for*

- implementation of a competent approach in shaping the structure and content of discipline;
- internal and external quality control of training specialists;
- accreditation of the educational program in the specialty.

*The work program sets:*

- scope and terms of teaching discipline;
- designation of physical quantities;
- disciplinary learning outcomes and their level of difficulty;
- thematic plan and the distribution of the volume of organizational forms of the educational process;
- requirements to the structure and content of an individual task;
- task for the independent work of the applicant;
- generalized diagnostic tools, criteria and procedures for assessing the achievements of applicants;
- the composition of the complex of teaching and methodological provision of discipline.

## 2 NORMATIVE REFERENCES

The work program of the discipline is developed on the basis of the following normative documents:

2.1 Educational program of preparation of bachelor's degree in specialty 124 "System analysis" / Ministry of Education and Science of Ukraine, National Mining University - D.: NMU, 2017. - 23 p.

2.2 Resolution of the Cabinet of Ministers of Ukraine dated December 30, 2015, No. 1187 Licensing conditions for the educational activities of educational institutions (Decree of the Cabinet of Ministers of Ukraine of December 30, 2015, No. 1187 "Licensing conditions for the educational activities of educational institutions").

2.3 Draft Standard of Higher Education Bachelor Degree Specialty 124 System Analysis.

2.4 Law of Ukraine "On Higher Education".

2.5 Standard of Higher Education of the State Higher Educational Institution "NMU" Design of the educational process. Dnipropetrovsk: NMU, 2016. - 74 p.

## 4 DESIGNATION OF PHYSICAL QUANTITIES

$x(t)$  is a vector that describes the state of the system;

$u(t)$  is the velocity vector;

$H(t)$  - Hamiltonian.

## 5 EXPECTED DISCIPLINARY LEARNING OUTCOMES

The code and the content of educational outcomes for an educational-professional program	Code and content of disciplinary learning outcomes (DLO)
1	2
PRN3 Know the methods of forecasting the dynamics of processes of different nature, be able to develop prediction functions;	DRN3-1 Analyze the domain and give a formal description of real systems.
	DRN3-2 To develop mathematical models of objects and processes, using procedures of the formal representation of the system and the results of research of real natural or socio-economic systems.
	DRN3-3 To apply methods of statistical modeling and forecasting, to perform evaluation of model output data
	DRN3-4 To develop mathematical models in the form of systems of differential equations, to use methods of solving differential equations
PRN6 Know and be able to apply the methods of genetic evolution modeling and optimization methods, inductive methods and mathematical modeling of fuzzy logic, neural networks, game theory and distributed artificial intelligence, etc.	DRN6-1 On the basis of methods of system analysis, to be able to deeply understand the features of natural, socio-economic and environmental processes that are subject to research and automation.
	DRN6-2 Analytically investigate mathematical models of objects and processes on the subject of existence and unity of its solution.
	DRN6-3 Ability to apply methods of regularizing a mathematical model in case of its incorrectness
RNS1 Know and be able to identify (estimate) the parameters of mathematical models of objects of control in real time in conditions of changing its dynamics and the effects of random perturbations using the measured signals of the input and output coordinates of the object	DNS1-1. Choose input and output parameters of the system
	DNS1-2 Identify the parameters of a mathematical model, analyze the suitability of a model for a real object or process.
	DNS1-3 Perform structural decomposition of the system by means of mathematical dependencies, heuristic approach, operational research
	DNS1-4 Identify the parameters of a mathematical model, analyze the adequacy of a model for a real object or process, using analytical and experimental methods for checking the consistency, sensitivity, realism and performance of the model

RNS4 To analyze the stability of dynamic systems, to apply stochastic regressive models and models in the state of space to describe the dynamics of processes of different nature	DNS4-1 Compose mathematical models of control systems, be able to mutually convert them
	DNS4-2 Be able to take into account nonlinear dependencies between system variables
	DNS4-3 Know the methods of analyzing the stability of control systems
	DNS4-4 To analyze the environment of the operation of the research object

### 3 THE SCOPE AND TERMS OF TEACHING DISCIPLINE

Total amount - 3 credits ECTS (90 academic hours).

It is taught at the 5th year, in the 1st semester, in the 1 st (7 th week) and the 2 nd quarter (6 th weeks).

### 6 THEMATIC PLAN AND DISTRIBUTION OF THE VOLUME OF DISCIPLINE BY TYPES OF TRAINING SESSIONS

DLO code	Kind and subjects of training sessions	Amount, <i>hours</i>		
		aud	CPC	all
1	2	3	4	5
	<b>lectures</b>	<b>26</b>	<b>20</b>	<b>46</b>
DRN3-1 DNS1-4 DNS4-1	Elementary mathematical models. Fundamental laws of nature. Variation principles. Hierarchical approach to model construction. Examples of models derived from the fundamental laws of nature	2	1	3
DRN3-1 DNS1-2	Universality of mathematical models. Liquid in U-shaped vessel. Sharp electric circuit. Small oscillations in the interaction of two biological populations. The simplest model for changing wages and employment.	2	1	3
DRN3-2 DNS4-1	Some models of the simplest nonlinear objects	2	1	3
DRN3-3 DNS1-3	General scheme of Hamilton's principle. Dynamic system "ball - spring"	2	1	3
DRN3-1 DNS1-1 DNS1-4	Universality of mathematical models. Dynamics of cluster amoeba. Random Markov process. Examples of analogy between mechanical, thermodynamic and economic objects	2	1	3
DRN3-4 DNS4-1	Organization of advertising campaign. Interdependence of enterprises' debts	2	1	3
DRN3-3 DNS4-1	Dynamic models of socio-economic systems. One-sector dynamic model of industry development in pure competition	2	2	4

DRN3-3 DNS1-1	Two-factor dynamic optimization model for the industry. A dynamic model of cyclical smoothing with the interaction of economies	2	2	4
DRN3-2 DNS4-3	Two-factor dynamic optimization model for the industry. A dynamic model of cyclical smoothing with the interaction of economies	2	2	4
DRN6-1 DNS4-2	Dynamic models of competitive systems with complete and incomplete information	2	2	4
DRN6-2 DNS1-1	Mathematical models of social, political processes and systems	2	2	4
DRN6-3	Dynamical systems management. Criterion of controllability of linear and nonlinear systems.	2	2	4
DRN6-1 DNS4-4	Software management in non-stationary systems. Class of admissible departments. The task of constructing a software control. The task of localization of movement. Pulse control software	2	2	4
	<b>Laboratory work</b>	<b>14</b>	<b>30</b>	<b>44</b>
DRN3-1 DNS4-2	Dynamics model of an industrial enterprise with participation external investment as a form of state support	2	4	6
DRN3-3	Model of dynamics of an industrial enterprise with non-linear production functions	2	4	6
DRN6-3 DNS4-1	The model of the industrial enterprise that uses one-time credit resource provided uniform debt repayment	2	4	6
DRN3-1 DNS4-2	Generalized dynamic model of strategic development analysis of an enterprise with the use of financial tools and combined funding schemes	2	4	6
DRN3-3 DNS1-2 DNS4-1	Advertising effectiveness. Supply and demand. Model of natural growth of output. Increase of release in conditions of competition	2	4	6
DRN6-2 DNS4-3	Market model with forecasted prices. Keynes dynamic model. Neoclassical growth model	2	5	7
DRN3-1 DNS1-4 DNS4-4	Research of stability and controllability of dynamic systems	2	5	7
	<b>Total</b>	<b>40</b>	<b>50</b>	<b>90</b>
	<b>Lectures (classroom - 2 hours per week)</b>	<b>26</b>	<b>20</b>	<b>46</b>
	<b>Laboratory classes (classroom - 1 hour per week)</b>	<b>14</b>	<b>30</b>	<b>44</b>
	<b>Final (semester) control-differentiated credit: II semester, 4 quarter</b>			

## 7 REQUIREMENTS FOR INDIVIDUAL TASKS

When studying the discipline provides for the implementation of an individual task.

The task is carried out in accordance with the methodological recommendations [15].

Purpose of the task:

- 1) generalization of competences acquired during the training;
- 2) development of the ability to apply discipline knowledge to develop mathematical models of specific processes and systems.
- 3) acquisition of the skills of calculating the parameters of the system or process.

In view of the task to carry out the following operations:

- 1) analyze a particular object or process, identify its main characteristics, components, properties;
- 2) compile a mathematical model of an object or process;
- 3) solve a model example; to prove the adequacy of the constructed mathematical model.

When evaluating the task, account shall be taken of:

- methods used;
- correctness and completeness of solving tasks;
- literacy, conciseness and logical sequence of presentation;
- ability to use computer tools for solving problems;
- correct execution of the explanatory note and its timely submission;
- Independence of performance (is diagnosed during protection).

## **8 TASKS FOR SELF-LEARNING**

The main tasks for independent work include:

- preliminary processing of information support for each topic;
- preparation for current control - solving tasks of self-control for each topic;
- performance of an individual task;
- preparation for the protection of individual tasks;
- preparation for the final (semester) control.

## **9 FORM OF FINAL CONTROL, DIAGNOSTIC TOOLS, CRITERIA AND EVALUATION PROCEDURES**

### **9.1 Form of final control**

The form of final control is a differential score.

Assessment of the level of formation of disciplinary competencies in the form of diff. the score may also be made without the student's participation, based on the results of the current control.

### **9.2 Forms of current control**

Determination of the level of the formation of disciplinary learning outcomes during the current control is carried out for:

- a certain section of the work program of discipline;
- laboratory work (inspection and protection);

### 9.3 Diagnostic tools

#### 9.3.1 Generalized diagnostic tools

Diagnostic tools are presented in the form of theoretical questions and concretized tasks with numerical input data and are designed to assess the student's ability:

- differentiate, integrate and unify knowledge;
- apply rules, methods, principles, laws in specific situations;
- interpret circuits, graphs, diagrams;
- analyze and evaluate the facts, events and predict the expected results from the decisions made;
- to present material on paper Logically, consistently, with the requirements of the current standards.

#### 9.3.2 Specified diagnostic tools

The precise diagnostic tools that are directly used for control measures during lectures are formed on the basis of generalized numerical or other concretization of generalized means in the form of closed and open type tests.

### 9.4 Criteria and evaluation procedures

#### 9.4.1 Lecture material

The evaluation of the results of the accomplished tasks is carried out by comparing them with the standards - samples of correct and complete answers by identifying the level of competence generation based on the analysis of the student's response using the coefficient of assimilation as a percentage that adapts the value of the assessment to the ECTS scale:

$$P_i = a / m (\%),$$

where –  $a$  number of correct answers or performed essential operations of decision standards;  $m$  – is the total number of questions or essential operations of the decision benchmark.

The results of the students' achievements (as a percentage) obtained from the described scheme are presented in the estimations of the ECTS and the national scale:

Marks, %	Grade
National Differentiated Scale	
90-100	Excellent
74-89	Good
60–73	Satisfactory
1-59	Fail
ECTS	

90-100	A
82-89	B
74-81	C
64-73	D
60-63	E
35-59	Fx
1-34	F

If the level of student achievement below 60% is fixed or if the student does not appear on a control event, then he is rated "Fx" and "unsatisfactory". In such cases, the student is obliged to further master this topic of classes and undergo a re-evaluation of his learning outcomes.

#### 9.4.2 Laboratory work

Each laboratory work is evaluated by the quality of the report by means of the coefficient of assimilation or by the expert method, when the maximum assessment is made subject to the following conditions:

- compliance with the report on the implementation of laboratory work methodological recommendations;
- correctness of execution;
- possession of theoretical knowledge on which the subject of research is based;
- possession of experimental research methods;
- general and professional literacy, conciseness and logical sequence of presentation of the material;
- compliance of the report with the current standards;
- availability of references to sources of information;
- independence of performance (it turns out during protection).

The level of achievements based on the results of a complex of laboratory work by discipline is defined as the average value of the results of the current control of each.

During the examination the evaluation for laboratory work is determined by the percentage of the correct steps of the algorithm for its implementation.

Integral assessment of achievements in all laboratory work is accepted (student's level of achievement is not less than 60% or at least 60 points) only if all the laboratory work provided by the program of the discipline is performed and evaluated.

#### 9.4.3 Integral level of student achievement in discipline

The integral level of student achievement in the mastery of discipline material as a whole is calculated as the weighted mean of the level of competence formation in lecture, practical and laboratory classes.:

$$IP = \sum_{i=1}^n \frac{(P_i \times T_i)}{T}, \%,$$

where –  $n$  number of types of training sessions;

$P_i$  – level of achievements for the  $i$ -th type of occupation, %;

$T_i$  – volume of the  $i$ -th type of occupation;

$T$  – total volume of discipline.

Achievements of a student in mastering a certain discipline in general can not be evaluated positively if from any planned control measure in this discipline the student has not received a positive assessment..

If the level according to the results of any current control measure is higher than 60%, then the national scale is rated "credited".

If the level according to the results of any current control measure is lower than 60%, then the discipline is rated "Fx" and, if below 35%, then "F". On the national scale in this case, the "unrecorded" score is displayed.

## **10 THE STRUCTURE OF THE COMPLEX OF TEACHING AND METHODOLOGICAL PROVISION OF DISCIPLINE**

The complex of teaching and methodological provision of discipline, should be located on the site of the department of system analysis and management and should contain:

- 1) work program of discipline;
- 2) educational content (information provision of lectures);
- 3) the task and methodical provision of laboratory work;
- 4) materials for methodological support of independent work of the student concerning:
  - preliminary processing of information provision of lectures;
  - solving self-control tasks for each topic
  - performance of an individual task;
  - preparation for the protection of individual tasks;
- 6) generalized tasks for the current control of the level of the formation of disciplinary competencies in the form of typical situational exercises with examples of solutions;
- 7) task for post-certification monitoring of the level of formation of disciplinary competencies.

## **11 RECOMMENDED BOOKS**

### **11.1 Basic**

1. Vasiliev F.P. Lectures on methods of solving extremal problems. - M.: Science. - 1974 - 376 p.
2. Fedorenko R.P. Approximate solution of optimal control problems. - M.: Science. - 1978 - 488 p.
3. Moiseev N.N. Elements of the theory of optimal systems. - Moscow: Nauka, 1971. - 562 p.
4. Fundamentals of the theory of optimal control. - M.: Higher school, 1990. - 432 p.
5. Egorov A.I. Optimal control of linear systems. - K.: Higher school, 1988. - 278 p.

6. Vasiliev F.P. Numerical methods for solving extremal problems. - M.: Science. - 1980 - 518 p.
7. Roytenberg Ya.N. Automatic control. - M.: Nauka, 1978.
8. Alekseev V.M., Tikhomirov V.M., Fomin S.V. Optimal control. - M.: Nauka, 1979.
9. Egorov A.I. Optimal control of thermal and diffusion processes. - M., Science, 1978.
10. Samarsky A.A, Mikhailov A.P. Mathematical modeling. Ideas Methods, Examples. - M.: Science. Fizmatlit, 1997. - 320 p.
11. Neiman Yu.I., Kogan N.Ya., Savelyev V.P. Dynamic control models. - M.: Science. Gl Editorial Board. Lit., 1985. - 400 c.
12. Differential Dynamic Models: Tutorial / B.I. Gerasimov, N.P. Puchkov, DN Protasov - Tambov: Publishing house GOU VPO TGTU, 2010. - 80 p

## 11.2 Auxiliary

1. Malafeev O.A., Muravyov A.I. Mathematical models of conflict situations and their resolution. Volume 1. General theory and auxiliary information. Publishing house SPBGU EIF SPb, 2000, 283p. Volume 2. Mathematical bases of modeling of processes of competition and conflicts in social and economic systems. Published by SPBGU EIF SPb, 2000, 294 p.
2. Malafeev O.A. Managed Conflict Systems. Publishing house of SPbGU, St. Petersburg, 2000, 276p.

Educational edition

Novitskiy Igor Valerievich  
Koryashkina Larisa Sergeevna

WORKING PROGRAM OF EDUCATIONAL DISCIPLINE  
"Mathematical Modeling and Analysis of Dynamic Systems"  
for masters of specialty 124 «System analysis»

Published  
at the State Higher Educational Institution  
"National Mining University".  
Certificate of entry in the State Register of Civil Code № 1842 dated 11.06.2004  
49005, Dnipropetrovsk, prosp. K. Marx, 19.

## APPENDIX 5.2

## PROGRAMS OF COURSES

№	Document	Link (uk)	Link (english)
CC2	Higher School Pedagogy	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9F%D0%B5%D0%B4%D0%B0%D0%B3%D0%BE%D0%B3%D0%B8%D0%BA%D0%B0%D0%92%D0%A8(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9F%D0%B5%D0%B4%D0%B0%D0%B3%D0%BE%D0%B3%D0%B8%D0%BA%D0%B0%D0%92%D0%A8(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_PedagogyOfThe_HigherSchool(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_PedagogyOfThe_HigherSchool(2017).pdf</a>
CC3	Philosophical Issues of Scientific Research	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%A4%D0%9F%D0%9D%D0%94(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%A4%D0%9F%D0%9D%D0%94(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_PHPSR(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_PHPSR(2017).pdf</a>
CC6	Master Thesis	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/Diplom_MAGISTR(NGU_SAU).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/Diplom_MAGISTR(NGU_SAU).pdf</a>	
EC1	Methodology of Scientific Research	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9C%D0%9D%D0%94(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9C%D0%9D%D0%94(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_Methodology_of_scientific_research(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_Methodology_of_scientific_research(2017).pdf</a>
EC2	Enterprise Economic Activity Analysis	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%95%D0%94%D0%9F%D0%94(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%95%D0%94%D0%9F%D0%94(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_EDEA(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_EDEA(2017).pdf</a>
EC3	Intellectual Data Analysis	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%90%D0%94(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%90%D0%94(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_Intellectual_DataAnalysis(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_Intellectual_DataAnalysis(2017).pdf</a>
EC4	Basics of Logistics	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9B%D0%BE%D0%B3%D0%B8">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9B%D0%BE%D0%B3%D0%B8</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_Logistics(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_Logistics(2017).pdf</a>

		<b>%D1%81%D1%82%D0%B8%D0%BA%D0%B0(2017).pdf</b>	
EC5	Complex Systems Self-Learning	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_CCC(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_CCC(2017).pdf</a>	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/Self_conditioning_of_complex_systems(Lecture)_NMU_SAU.pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/Self_conditioning_of_complex_systems(Lecture)_NMU_SAU.pdf</a>
EC6	Discrete Optimization	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9C%D0%94%D0%9E_2017.pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9C%D0%94%D0%9E_2017.pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_DiscreteOptimizationMethods(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_DiscreteOptimizationMethods(2017).pdf</a>
EC7	Game Theory in the Conflict Situation Studies	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%A2%D0%98%D0%9A%D0%A1(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%A2%D0%98%D0%9A%D0%A1(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_GTECS(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_GTECS(2017).pdf</a>
EC8	Integrated Management Systems	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%98%D0%A1%D0%A3(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%98%D0%A1%D0%A3(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_IMS(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_IMS(2017).pdf</a>
EC9	Mathematic Modelling and Analysis Dynamic System	<a href="http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9C%D0%9C%D0%90%D0%94%D0%A1(2017).pdf">http://sau.nmu.org.ua/ua/osvita/metod/magistr/%D0%BF%D1%80%D0%BE%D0%B3%D1%80%D0%B0%D0%BC%D0%B0_%D0%9C%D0%9C%D0%90%D0%94%D0%A1(2017).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/magistr/program_MMADS(2017).pdf">http://sau.nmu.org.ua/en/osvita/magistr/program_MMADS(2017).pdf</a>

## APPENDIX 5.3

### Questionary for Course Evaluation

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 Name of the course

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 Name of the lecturer

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 Date of filling in the questionnaire

General course evaluation	Technical Evaluation of the implementation of the Course
1. How has the course enriched your knowledge about the taught subject? A. Very much      B. More or less C. Not really      D. I don't know	A. Yes    B. More or less    C. Not really    D. I don't know
2. Were prerequisites determined in a proper way? A. Yes      B. No      C. I don't know	1. Were consultations/contact hours available to a sufficient level?
3. Are books, scripts, etc., assigned to this course available in library/on-line access? A. Yes      B. Not always C. No      D. I don't know	2. Did participation in the course help you to understand content of other courses?
4. Does the program of the course repeat the content from other courses? A. No      B. Usually no C. Yes      D. I don't know	3. Were classes implemented in accordance with the syllabus of the course?
5. Is the time spent on the course proper/too short/too long? A. Proper      B. Too short C. Too long      D. I don't know	4. Were methods of teaching in class interesting?
6. How would you rate the relationship of the course with general profile of education on your field of study? A. Related      B. Partly related C. Not related      D. I don't know	5. Has Lecturer clearly presented the issues using support of audiovisual means/projector/presentation etc.?
7. Did the course meet your expectations? A. Very much      B. More or less C. Not really      D. I don't know	6. Was the material presented well prepared and presented in consecutive way?
	7. Has Lecturer led to inspire students to think for themselves?
	8. Were examples well matched to presented problems?
	9. Has Lecturer explained difficult issues in an understandable and transparent way?
	10. Were classes held at an appropriate tempo?
	11. Has Lecturer been communicative enough?
	12. Are the requirements for students clearly defined?
	13. Has the Lecturer friendly attitude to the students?
	14. Do classes take place on time and regularly?

Self-assessment of respondent	Evaluation of usefulness of Questionnaire
<p>1. What was your average grade in the previous semester?</p> <p>A. A-B                      B. B-C C. C-D                      D. Less than D</p> <p>2. How often have you participated in the activities of this course?</p> <p>A. About 100%          B. About 75% C. About 50 %          D. About 25%</p> <p>3. How many hours a week in average you devoted to learn this course (excluding class hours)?</p> <p>A. 0                          B. 1-2 C. 3-5                      D. More than 5</p> <p>4. Did you use the opportunity to contact Lecturer during contact hours?</p> <p>A. Often    B. Sometimes    . Never</p> <p>5. Do you think you were prepared good enough enrolling for this course?</p> <p>A. Yes                      B. More or less C. Not really              D. I don't know</p> <p>6. How would you rate (grade) yourself for this course?</p> <p>A. Very good    B. Good C. Good enough    D. Not good enough</p> <p>7. What was your grade you received for this course?</p> <p>A. A-B                      B. B-C C. C-D                      D. Less than D</p> <p>8. A. Male                      B. Female</p>	<p>A. Yes                      B. No                      C. I don't know</p> <p>1. Do you believe in the usefulness of this survey?</p> <p>2. Whether the results of this survey may be useful for students?</p> <p>3. Should the results of this survey be published?</p> <p>4. Is the survey form understandable/transparent?</p> <p>5. Did you have enough time to complete the survey?</p>

## APPENDIX 5.4

### Links to Documents and Units on the University's Website

№	Document	Link (uk)	Link (english)
1	Questionnaires for students, graduates, employers	<a href="http://sau.nmu.org.ua/ua/osvita/opros.php">http://sau.nmu.org.ua/ua/osvita/opros.php</a>	
2	Analysis of the survey results of employers' claims	<a href="http://sau.nmu.org.ua/ua/abitur/%D0%90%D0%BD%D0%B0%D0%BB%D0%B8%D0%B7_%D0%BE%D0%BF%D1%80%D0%BE%D1%81_%D1%80%D0%B0%D0%B1%D0%BE%D1%82%D0%BE%D0%B4%D0%B0%D1%82%D0%B5%D0%BB%D0%B5%D0%B9(124%D0%A1%D0%B8%D1%81%D1%82%D0%B5%D0%BC%D0%BD%D1%8B%D0%B9%D0%90%D0%BD%D0%B0%D0%BB%D0%B8%D0%B7).pdf">http://sau.nmu.org.ua/ua/abitur/%D0%90%D0%BD%D0%B0%D0%BB%D0%B8%D0%B7_%D0%BE%D0%BF%D1%80%D0%BE%D1%81_%D1%80%D0%B0%D0%B1%D0%BE%D1%82%D0%BE%D0%B4%D0%B0%D1%82%D0%B5%D0%BB%D0%B5%D0%B9(124%D0%A1%D0%B8%D1%81%D1%82%D0%B5%D0%BC%D0%BD%D1%8B%D0%B9%D0%90%D0%BD%D0%B0%D0%BB%D0%B8%D0%B7).pdf</a>	<a href="http://sau.nmu.org.ua/en/osvita/Analysis_of_the_survey_of_employers.pdf">http://sau.nmu.org.ua/en/osvita/Analysis_of_the_survey_of_employers.pdf</a>
3	Web site of the department	<a href="http://sau.nmu.org.ua/ua/">http://sau.nmu.org.ua/ua/</a>	<a href="http://sau.nmu.org.ua/en/">http://sau.nmu.org.ua/en/</a>
4	Educational program	<a href="http://sau.nmu.org.ua/ua/osvita/Program_bakalavr_magistr(2017).php">http://sau.nmu.org.ua/ua/osvita/Program_bakalavr_magistr(2017).php</a>	<a href="http://sau.nmu.org.ua/en/osvita/programme/Educational_and_professional_programme_speciality124_Master_degree(en_2017).pdf">http://sau.nmu.org.ua/en/osvita/programme/Educational_and_professional_programme_speciality124_Master_degree(en_2017).pdf</a>
5	Curriculum	<a href="http://sau.nmu.org.ua/ua/osvita/plan.php">http://sau.nmu.org.ua/ua/osvita/plan.php</a>	<a href="http://sau.nmu.org.ua/en/osvita/plan.php">http://sau.nmu.org.ua/en/osvita/plan.php</a>
6	Double Degree Agreement	<a href="http://sau.nmu.org.ua/ua/abitur/AGREEMENT_ON_NMU(UKR)_and_University_of_Koblenz-Landau(GEMANY).PDF">http://sau.nmu.org.ua/ua/abitur/AGREEMENT_ON_NMU(UKR)_and_University_of_Koblenz-Landau(GEMANY).PDF</a>	<a href="http://sau.nmu.org.ua/ua/abitur/AGREEMENT_ON_NMU(UKR)_and_University_of_Koblenz-Landau(GEMANY).PDF">http://sau.nmu.org.ua/ua/abitur/AGREEMENT_ON_NMU(UKR)_and_University_of_Koblenz-Landau(GEMANY).PDF</a>
7	Admission rules	<a href="http://www.nmu.org.ua/ua/content/study/admission/umovi_vstupy/ngu/">http://www.nmu.org.ua/ua/content/study/admission/umovi_vstupy/ngu/</a>	
8	Schedule of exams	<a href="http://www.nmu.org.ua/ua/content/student_life/students/schedule/">http://www.nmu.org.ua/ua/content/student_life/students/schedule/</a>	
9	Results of teacher ratings	<a href="http://sau.nmu.org.ua/ua/">http://sau.nmu.org.ua/ua/</a>	
10	Annotations of disciplines	.	<a href="http://sau.nmu.org.ua/en/osvita/Library.php">http://sau.nmu.org.ua/en/osvita/Library.php</a>
11	Themes of master's thesis	<a href="http://sau.nmu.org.ua/ua/osvita/diplom/%D1%82%D0%B5%D0%BC%D0%B8_%D0%B4%D0%B8%D0%BF%D0%BB%D0%BE%D0%BC_%D1%80%D0%BE%D0%B1_124%D0%BC_16_1.pdf">http://sau.nmu.org.ua/ua/osvita/diplom/%D1%82%D0%B5%D0%BC%D0%B8_%D0%B4%D0%B8%D0%BF%D0%BB%D0%BE%D0%BC_%D1%80%D0%BE%D0%B1_124%D0%BC_16_1.pdf</a>	<a href="http://sau.nmu.org.ua/ua/osvita/diplom/%D1%82%D0%B5%D0%BC%D0%B8_%D0%B4%D0%B8%D0%BF%D0%BB%D0%BE%D0%BC_%D1%80%D0%BE%D0%B1_124%D0%BC_16_1.pdf">http://sau.nmu.org.ua/ua/osvita/diplom/%D1%82%D0%B5%D0%BC%D0%B8_%D0%B4%D0%B8%D0%BF%D0%BB%D0%BE%D0%BC_%D1%80%D0%BE%D0%B1_124%D0%BC_16_1.pdf</a>

12	<p>Language centers</p> <ul style="list-style-type: none"> <li>•Ukrainian-American Linguistic Center</li> <li>•Ukrainian-German Cultural Center</li> <li>•Ukrainian-Spanish Cultural-Linguistic Center</li> <li>•Center for Ukrainian-Polish Cooperation</li> <li>•Ukrainian-Japanese Center</li> <li>• Language training center</li> <li>• Ukrainian-Chinese Cultural-Linguistic Center</li> </ul>	<p><a href="http://u-alc.nmu.org.ua/">http://u-alc.nmu.org.ua/</a></p> <p><a href="http://u-dlc.nmu.org.ua/ua/general/general.php">http://u-dlc.nmu.org.ua/ua/general/general.php</a></p> <p><a href="http://uhic.nmu.org.ua/ua/">http://uhic.nmu.org.ua/ua/</a></p> <p><a href="http://pl.nmu.org.ua/index.php/en/">http://pl.nmu.org.ua/index.php/en/</a></p> <p><a href="http://u-jc.nmu.org.ua/ua/">http://u-jc.nmu.org.ua/ua/</a></p> <p><a href="http://cmp.nmu.org.ua/ua/">http://cmp.nmu.org.ua/ua/</a></p> <p><a href="http://www.nmu.org.ua/ua/content/cooperation/ua_china_cent/">http://www.nmu.org.ua/ua/content/cooperation/ua_china_cent/</a></p>	
13	Business incubator	<a href="http://bi.nmu.org.ua/ua/">http://bi.nmu.org.ua/ua/</a>	
14	Sport life	<a href="http://www.nmu.org.ua/ua/content/student_life/sportlife/">http://www.nmu.org.ua/ua/content/student_life/sportlife/</a>	
15	Cultural and educational center	<a href="http://www.nmu.org.ua/ua/content/student_life/cultural_life/">http://www.nmu.org.ua/ua/content/student_life/cultural_life/</a>	
16	Coworking Center	<a href="https://www.facebook.com/GEOhub-1036915129706430/">https://www.facebook.com/GEOhub-1036915129706430/</a>	
17	Sector of scientific and technical creativity of youth	<a href="http://www.nmu.org.ua/ua/content/student_life/students/science.php">http://www.nmu.org.ua/ua/content/student_life/students/science.php</a>	
18	Department of Internal Quality Assurance in Higher Education	<a href="http://www.nmu.org.ua/ua/content/infrastructure/structural_divisions/Internal_quality_higher_education/index.php">http://www.nmu.org.ua/ua/content/infrastructure/structural_divisions/Internal_quality_higher_education/index.php</a>	

## APPENDIX 7.1

### Quality Composition of the Graduation Department of System Analysis and Control in Specialty 124 "System Analysis"

№ з/п	Group head's and members' surnames, names and patronymics	Job title (for part-time employees – primary employment, job title)	Institution of graduation (graduation year, speciality, qualification according to the document of higher education)	Academic degree, academic speciality code and subject area, dissertation theme, academic rank, department (speciality)	Duration of scientific and pedagogical activities and/or scientific activities (years)	Information about scientific activity (main publications in the subject area, research work, participation in conferences and seminars, work with post- graduate and doctoral students, academic advising)	Information about qualification im- provement of lec- turer (name of in- stitute, type of document, subject, issue date)
1	2	3	4	5	6	7	8
<b>1. Persons who work at the main work place</b>							
1.	Slesarev Volodymyr Viktorovych	Head of System Analysis and Control Depart- ment, Professor	Dnipropetrovsk Mining Institute, 1976, majoring in Automation and Teleautomatics, electrical engineer	Doctor of Technical Sciences, 05.13.07 – Automation of technological pro- cesses, Professor of System Analysis and Control De- partment, doctoral dissertation “Auto- mation of energy intensive flow tech- nologies control at ore mining and smelting factories”	39	1. Slesarev V. V. Upravlennja transportom na ugol'noj shahte pri ispol'zovanii sistemy raschetnogo obosno-vanija. / Malienko A. V., Sle- sarev V. V. // Nacional'nyj gornyj universitet. Nauko-vij visnik.- Vypusk (1). - Dnepropetrovsk, 2014. - S.62 –662. (Rus) 2. Malienko A. V Algoritm upravlennja proizvodstven-nym kompleksom na osnove tehnologii raschetnogo obos- novanija dispetcherizacii ugol'nyh shaht./ Malienko A. V., Slesarev V. V. // XI-ja Me-zhdunarodnaja konferencija “Problemy ispol'zovanija informacionnyh tehnologij v sfere obrazovanija, nauki i promyshlennosti» (26-27 fe-vralja 2014); Sb. nauch. Tr.	Centre of Engineering Pedagogics, Certificate of advanced training No. 026, 21/05/2014? gradu- ate paper “«Поняття множин та їх власти- вості»

						<p>Nac. Gorn .un-ta /- D.: Na-cional'nyj gornyj univer-sitet, 2014. - №. Str (Rus)</p> <p>3. Slesarev V.V., Mirgorodskij A.V. Metod poiska optimal'nyh reshenij sis temy upravljenja processami likvidacii avarij na shahtah // Sb. nauchnyh trudov NGU. №48. – 2015.- S. 164 – 171. (Rus)</p> <p>4. Slesarev V.V., Margitich V.S. Ontologicheskaja model' bazy znanij upravljenja silami i sredstvami pri likvidacii avarij na shahtah // Sb. nauchnyh trudov NGU. №49. – 2015.- S. 172 – 179. (Rus)</p> <p>5. V. Slesarev Probability estimates for the operation modes of mining machinery and equipment overshooting the limits of their normal functioning. / V. Slesarev, A. Malienko // Progressive Technologies of Coal, Coalbed Methane, and Ores Mining – Bondarenko, Kovalevs'ka &amp; Ganushevych (eds) 2015 Taylor &amp; Francis Group, London, P.393-395.</p> <p>6. Slesarev V. V. Upravljenja transportom na ugol'noj shahte pri ispol'zovanii sistemy raschetnogo obosnovanija. / Malienko A. V., Slesarev V. V. // Nacional'nyj gornyj universitet. Naukovij visnik.- Vypusk (1). - Dnepropetrovsk, 2014. - S.62 –66. (Rus)</p> <p>7. Zheldak T.A. The algorithm of artificial immune system simulation with Saaty selection operator and one-dimensional local search / T. A. Zheldak, V. V. Slesarev, I. G. Gulina // Naukovij visnik</p>	
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						Nacional'nogo gornichogo universitetu. – 2016. - №5 – s. 149–156.  Supervises one post-graduate student, has prepared 3 post-graduate students for defense. Takes part in the department research activities. Conducts instruction for Specialists and Masters.	
2.	Kupenko Olha	Full professor of the System Analysis and Management department	Dnipropetrovsk National University, 2006, specialty «Statistics», master qualification.	Doctor of Physics and Mathematics Sciences in specialty 01.05.01 - theoretical fundamentals of informatics and cybernetics, full professor of the System Analysis and Management department, the dissertation on the topic "Approximation of optimization problems for nonlinear elliptic systems with degenerate and singular coefficients", Associate Professor at the Department of System Analysis and Management	10 years	1. Kupenko O.P. On Existence and Attainability of Solutions to Optimal Control Problems in Coefficients for Degenerate Variational Inequalities of Monotone Type / Olha P. Kupenko // Continuous and Distributed Systems, Series: Solid Mechanics and Its Applications 211, Springer, 2013, DOI: 10.1007/978-3-319-03146-0, P. 287-301.  2. Kupenko O.P. On Optimality Conditions for Optimal Control Problem in Coefficients for $\Delta$ -Laplacian / Olha P. Kupenko, Rosanna Manzo // Boundary Value Problems 2014, 2014:72, P. 1-29. <a href="http://www.boundaryvalueproblems.com/content/2014/1/72">http://www.boundaryvalueproblems.com/content/2014/1/72</a> .  3. Kogut P.I. Optimal Control Problems in Coefficients for Nonlinear Dirichlet Problems of Monotone Type: Optimality Conditions. Part I / P.I. Kogut, O.P. Kupenko, G. Leugering // Zeitschrift für Analysis und ihre Anwendungen. – 2015. – Vol. 34. – Issue 1. – pp. 85-108. DOI: 10.4171/ZAA/1530  4. Kogut P.I. Optimal Control Problems in Coefficients for Nonlinear Dirichlet Problems of Monotone Type: Optimality Conditions. Part II / P.I.	The Defence of Habilitation Thesis in 2017.

						<p>Kogut, O.P. Kupenko, G. Leugering // Zeitschrift für Analysis und ihre Anwendungen. – 2015. – Vol. 34. – Issue 2. – pp. 199-219. DOI: 10.4171/ZAA/1536</p> <p>5. Kupenko O.P. On Existence of Weak Optimal Controls in Coefficients for Degenerate Anisotropic p-Laplacian / O.P. Kupenko, G. Leugering // Continuous and Distributed Systems II. Series: Studies in Systems, Decision and Control 30. – Warsaw: Springer, 2015. – pp. 315-337. DOI: 10.1007/978-3-319-19075-4_19</p> <p>6. Kupenko O.P. Optimal Control Problems in Coefficients for Coupled System of Hammerstein Type / O.P. Kupenko, R. Manzo // Discrete and Continuous Dynamic Systems. Series B. – 2015. – Vol. 20. – № 9. – pp. 2967-2992.</p> <p>7. Kupenko O.P. Approximation of an Optimal Control Problem in the Coefficient for Variational Inequality with Anisotropic p-Laplacian / O.P. Kupenko, R. Manzo // Nonlinear Differential Equations and Applications. – 2016. – Vol. 23. – Issue 3. – 18 p. DOI: 10.1007/s00030-016-0387-9</p> <p>8. Durante T. On Attainability of Optimal Controls in Coefficients for System of Hammerstein Type with Anisotropic p-Laplacian / T. Durante, O.P. Kupenko, R. Manzo// Ricerche di Matematica. – June 24, 2016. – 32 p. DOI:10.1007/s11587-016-0300-1</p>	
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3.	Novitskii Igor Valeriovych	Professor of System Analysis and Control Department	Dnipropetrovsk Mining Institute, 1979, majoring in Automation and Teleautomatics, electrical engineer	Doctor of Technical Sciences, 1993, "Automatic optimization of ore self-grinding in tumbling mills", Professor of System Analysis and Control Department	37	<p>1 Novickij I.V., Shevchenko Ju.A "Razrabotka i issledovanie adaptivnoj sistemy upravlenija zagruzkoj barabannyh mel'nic" / Zbirnik naukovih prac' "XI mizhnarodna konferencija z problem vikoristannja informacijnih tehnologij v osviti, nauci ta promislovosti". – D.: DVNZ «Nacional'nij girnichij universitet», 2014. (Rus)</p> <p>2. Shevchenko Ju.O. Rozrobka ta doslidzhennja adaptivnoi' systemy upravlinnja zavantazhennja barabannyh mlyniv / I.V.Novyc'kyj, Ju.O.Shevchenko // Materialy mizhnarodnoi' konferencii' z problem vykorystannja informacijnyh tehnologij v osviti, nauci ta promyslovosti. – D.: DVNZ «Nacional'nyj girnychyj universytet», 2014. (Ukr)</p> <p>3. Novyckyj Y.V. Razrabotka metoda ydentyfikacyy dlja zadach adaptivnogo upravlenija podgotovytel'nyh processamy obogashhenija rud / Y.V.Novyckyj, Ju.A.Shevchenko // Zbirn. nauk. prac' NGU, №48, 2016, stor 5. (Rus)</p> <p>4. Novitsky I.V. Adaptive System of Controlling The Coarse Crushing Process // I.V. Novitsky, A.M. Us / Sistemnye tehnologii. T.4 (105). 2016. S.69 – 75.</p> <p>5. Novyc'kyj I.V., Us S.A. Vypadkovi procesy. Navch. posibn.// Dnipropetrovs'k, NGU, 2014, 132 s (Ukr)</p> <p>6. Novyc'kyj I.V. Suchasna teorija keruvannja: navch. posib./I.V.</p>	Centre of Engineering Pedagogics, Certificate of advanced training No. 027, , 21.05.2014
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						Novyc'kyj, S.A. Us, m-vo osvity i nauky Ukrainy, Nac. girn. un-t. – Dnipro: NGU, 2017. – 263. (Ukr)	
						Conducts instruction for Specialists and Masters.	
4.	Us Svitlana Albertivna	Professor of the System Analysis and Control Department	Dnipropetrovsk State University, 1987, Speciality "Applied Mathematics", diploma with high honours MB-I	Candidate of Physical and Mathematical Sciences in speciality 05.13.18 "Theoretical Basics in Mathematical Modelling, numerical methods and Software System", theme of dissertation "Solution of one class of infinite-dimensional optimization problems" Diploma KH No. 000056, Associate Professor (since December, 2001) of the System Analysis and Control Department.	30	<p>Research interests – decision making, namely, in the area of uncertainty, infinite-dimensional optimization. Over the last 5 years, S. Us has published over 50 scientific and pedagogical papers plus two manuals classified by the Ministry of Education and Science of Ukraine</p> <p>Major publications:</p> <p>6. Us S. A. Application of the optimal set partitioning method to problem of wireless network engineering. // <b>Energy Efficiency Improvement of Geotechnical Systems - International Forum on Energy Efficiency. – CRC Press/ Balkema - Taylor &amp; Francis Group. – 2013. – P. 175–181</b></p> <p>7. Us S.A, Stanina O.D Multi-stage problem of concentration plant location // 6th International Academic Conference of Young Scientists "Computer Science and Engineering 2013" (CSE-2013) / 4th International Youth Science Festival "Litteris et Artibus" November 21–23, 2013 Lviv Polytechnic National University</p> <p>8. Kiseleva E.M. Teoriia optimalnogo razbiieniiia mnozhestv v zadachakh raspoznavaniia obrazov, analiza i identifikatsii sistem (Monograph)//</p>	<p>Centre of Engineering Pedagogics, Certificate of advanced training No. 018, graduate paper "Efficient alternatives and their properties", 21.05.2014</p> <p>Diploma IGIP No. UA-157, 2014</p> <p>Summer Academy within the Erasmus+ project "Quality assurance system in Ukraine: development on the base of ENQA standarts and guidelines", University of Koblenz-Landau, 10-24 july, 2016</p> <p>Training session on design of dual degree programs University of Koblenz-Landau, 11-15 december 2016</p>

					<p>E.M. Kiseleva, L.S. Koriashkina, S.A. Us // Ministry of Education and Science of Ukraine; National Mining University. – D.: NMU, 2015. –270 p.</p> <p>9. Kiseleva E.M., Us S.A., Stanina O.D. O zadachakh optimalnogo razbiienii mnozhestv s dopolnitelnymi sviaziami // Pytannia prykladnoi matematyky i matematychnoho modelivannia, Dnipropetrovsk, DNU Publishing Company, 2016, P. 67-78.</p> <p>10. Ishchenko A.K. Mathematical justification on the choice of explosive material to rupture strong rocks of complex structure / A.K. Ishchenko, S.A. Us, A.V. Solovev, K.S. Ishchenko // Metallurgical and Mining Industry, No. 5 – 2017, c 42 – 45</p> <p>Manuals classified by the Ministry of Education and Science of Ukraine</p> <p>1. Novytskyi I.V. Vypadkovi protsesy [Text]: manual / I.V.Novytskyi, S.A.Us. – D.: NHU, 2014, – 193 p.</p> <p>2. Us S.A., Koriashkina L.S. Modeli ta metody pryiniattia rishen [Text]: manual / S.A. Us, L.S. Koriashkina– D.: NMU. – 2014. – 300p.</p>	
5.	Zheldak Timur Anatolijovych	Associate Professor of System Analysis and Control Department	Dnipropetrovsk State Mining Academy (1997), Electric drive and automation of industrial plants and technological complexes, electromechanical engineer	Candidate of Technical Sciences, 05.09.03 “Electrotechnical complexes and systems”. Dissertation “Parameters intensification of the induction motor with a cage rotor as a part of the automated	<p>1. Zheldak T.A. Zastosuvannja zvorotnyh zalezhnostej u matematychnyh modeljah skladnyh ob’ektiv ta system / T.A. Zheldak // Systemni doslidzhennja ta informacijni tehnologii’. — 2012. — № 3. — S. 95–106. (Ukr)</p> <p>2. Slesaryev, V.V. Using of the Tabu search method in optimization the rolled stock layout / V.V. Slesaryev, T.A. Zheldak, D.M. Garanzha and O.D. Stanina // Scientific Reports on Resource Issues. Vol. 2, 2012:</p>	Doctoral studies at NSU "NMU" 2010-2013

				complex”, Associate Professor of System Analysis and Control Department	<p>Rock Strength, Rock Fragmentation and Effective Use of Energy Potential of Geotechnical Systems. – TU Bergacademie Freiberg. – p. 87-99.</p> <p>3. Sljesarjev V.V. Matematychna model' material'no-teplovogo balansu plavky v kysnevomu konverteri ta kryterij ii' optymizacii' / V.V. Sljesarjev, T.A. Zheldak // Naukovyj visnyk Nacional'nogo gimnychoho universytetu. – 2013. - №1 – s. 97–102. (Ukr)</p> <p>4. Zheldak T.A. Adaptacija metodu modeljubvannja kolonii' murah do rozv'jazannja kombinatornyh zadach planuvannja vykonannja zamovlen' metalurgijnyh pidpryjemstvamy // Matematychni mashyny ta systemy. – 2013. - №4 – s 95-106. (Ukr)</p> <p>5. Zheldak T.A. Metod modeljubvannja shtuchoi' imunnoi' systemy z selektyvnyh operatorom Saati ta odnovymym lokal'-nym poshukom / T.A. Zheldak, V.V. Sljesarjev // Yskusstvennij yntellekt. – 2013. №4. – s. 101-112. (Ukr)</p> <p>6. Zheldak, T.A. Knowledge-Based Intellectual DSS of Steel Deoxidation in BOF Production Process. / T.A. Zheldak, V.V. Slesarev, and D.O. Volovenko // American Journal of Mining and Metallurgy 1.1 (2013): 7-10.</p> <p>7. T.A., Zheldak, and Redko V. "Using an Evolutionary Heuristics for Solving the Outdoor Advertising Optimization Problem." Journal of Computer Sciences and Applications 2.2 (2014): 23-30. DOI: 10.12691/jcsa-2-2-2.</p> <p>8. Zheldak T.A. The algorithm of artificial immune system simulation with Saaty selection operator and one-</p>	
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						dimensional local search / T. A. Zheldak, V. V. Slesarev, I. G. Gulina // Naukovyj visnyk Nacional'nogo girnychogo universytetu. – 2016. - №5 – s. 149– 156.  Participated in more than 40 interna- tional conferences and seminars. Head of the student academic society of the department	
6.	Mineyev Oleksandr Ser- gijovych	Associate Profes- sor of System Analysis and Management Department	Dnipropetrovsk National Mining University (2009, «Software of automated systems», programmer engineer)	Ph.D. thesis spe- cialty 05.13.07 – Automation of management processes, sub- ject «The system of intelligent decision-making support for liquidation of accidents at mines», 2013		1. Slesarev V. V. Математиче- ская модель виброрыхления агрегированной углепородной среды / Slesarev V. V., Mineyev A.S.// Вісник НГУ, 2012. – №1.– С. 113–117. 2. Минеев С.П. Основные тех- нологические решения по эф- фективной разгрузке смерз- шегося груза из железнодоро- жных полувагонов / С.П. Ми- неев, М.А. Выгодин, Mineyev A.S.// Мости и тунелі: теорія, дослідження, практика. Збір- ник наукових праць Дніпропе- тровського національного уні- верситету залізничного транс- порту імені академіка В. Лазаряна. –Вип. 1. – Д.: ДНУЗТ, 2012.– С. 49–54. 3. Пат. на корисну модель № 66892 Україна Пристрій для розпушування змерзлих і	Ph.D. thesis spe- cialty 05.13.07 – Automation of management processes, subject «The system of intelligent decision-making support for liquidation of accidents at mines», 2013

						злежалих матеріалів у піввагонах / Мінесев С.П., Прусова А.А., Mineyev A.S.. 3-ка № u201107458, заявл. 14.06.11р; опубл. 25.01.2012р. Бюл.№ 2, 12р.	
7.	Alekseev Oleksii Myhajlovych	Associate Professor of System Analysis and Management Department	National Mining University, 2006, «Information management systems and technologies», programmer engineer with the research activity of the instructor of a higher institution, a master's degree with honors	Candidate of Technical Science. specialty 05.13.07 – Automation of management processes, subject «The system of intelligent decision-making support for liquidation of accidents at mines», 2014	Integrated control systems (36 hours)	<p>1. «Система интеллектуальной поддержки принятия решений при ликвидации аварий на шахтах» - Монография, Алексеев А.М., Державний ВНЗ «НГУ», 2015 р.–142 с.</p> <p>2. Моделирование процессов распределения воздуха на сетевых моделях вентиляционных систем шахт при ликвидации аварий // III Міжнародна науково-практична конференція 12-15 травня 2015 року Україна Київ-Черкаси «Обчислювальний інтелект (результати проблеми перспективи)» ст. 167-168.</p> <p>3. О. Aleksieiev. Simulation of methane concentration process control at coalmine // О. Aleksieiev &amp; T. Vysotskaya // Power engineering control &amp; information technologies in geotech-</p>	<p>1. Ph.D. thesis specialty 05.13.07 – Automation of management processes, subject «The system of intelligent decision-making support for liquidation of accidents at mines», 2014</p> <p>2. International Society of Engineering Pedagogy IGIP The title International Engineering Educator “Ing.Paed.IGIP” Villach, 16 September 2015, UA-164</p>

						<p>nical systems // CRC Press Taylor &amp; Francis Group/ Balkema Book/ 2015 y. pages 171–178.</p> <p>4. А.М. Алексеев Разработка оперативных планов ликвидации шахтных аварий на базе прецедентного подхода // А.М. Алексеев// Збірн. наук. праць НГУ. – 2014. – № 44. – С. 120-129.</p> <p>5. Алексеев А.М. Расчет больших сетевых моделей с параметрическими элементами различной степени нелинейности / А.М. Алексеев // Науковий вісник НГУ. – 2013. – № 4 (136). – С. 95–100.</p>	
8.	Khomyak Tetyana Valerijivna	Associate Professor of System Analysis and Management Department	Donetsk National University, 2002, «Applied Mathematics», mathematician	Candidate of Physical and Mathematical sciences, Ph.D. 01.02.01 – Theoretical mechanics, Dissertation subject «Influence of additional tones of fluid oscillation on the stability and stabilization of	1. Basics of logistics (36 hours)	<p>1. Khomyak T.V. On one case of integrability of the equations of motion of a solid in a magnetic field / T.V. Khomyak, A.V. Zyza // Visnyk of the Donetsk National University, Series. A: Natural sciences. - 2012. - Exp. 2. - P. 31-35.</p> <p>2. Khomyak T.V. Stabilization of the unstable rotation of the Lagrange peak with a fluid by rotating solids / T.V. Khomyak // Proceedings of the IAMM. - 2012. - T.25. - P. 260-267.</p>	<p>1. Donetsk State University of Management, certificate AB № 0123004, methodical seminar «Microsoft Live@Edu - technological offer for education», 2011.</p> <p>2. Donetsk State University of</p>

				<p>the rotation of a non-free top of the Lagrange with an ideal fluid», Associate Professor of System Analysis and Management Department</p>	<p>3. Khomyak T.V. Influence of additional tones of fluid oscillation on the stability and stabilization of the rotation of a non-free top of the Lagrange with an ideal fluid / T.V. Khomyak // Visnyk of the Donetsk National University, Series. A: Natural sciences. - 2013. - Issue 1. - P. 83-89.</p> <p>4. Khomyak T.V. Solid-liquid simulation of a system of coupled solids / T.V. Khomyak // Scientific papers of Donetsk National Technical University, Series: Problems of modeling and automation of designing. - No. 1 (12) -2 (13). - 2013. - pp. 102-110.</p> <p>5. Khomyak T.V Development of information management system for student hostel number 1 DonNTU / T.V. Khomyak, A.V. Kravchenko // Information control systems and computer monitoring: Collection of abstracts of V international scientific and technical conference of students, postgraduates and young scientists. - Donetsk, 2014. - P. 392-397.</p> <p>6. Khomyak T.V. Synthesis of</p>	<p>Management, certificate BH № 121013, scientific and methodological seminar "University complex - the form of innovative development of educational institutions", 2011.</p>
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						<p>the information system of the registration and analysis of students morbidity in higher educational institutions / T.V. Khomyak, A.S. Korobko // Information control systems and computer monitoring: Collection of theses of V international scientific and technical conference of students, postgraduates and young scientists. - Donetsk, 2014. - pp. 385-392.</p> <p>7. Khomyak T.V. Development of information management system for cash flows of the enterprise "Donbassresstroy" / T.V. Khomyak, A.V. Evdokimova // Information control systems and computer monitoring: Collection of theses of V international scientific and technical conference of students, postgraduates and young scientists. - Donetsk, 2014. - P. 398-399.</p>	
9.	Koriashkina Larysa Sergi- jivna	Associate Pro- fessor of System Analysis and Management Department	Dnipropetrovsk State University, 1992 p., «Applied Mathematics», mathematician	Candidate of Physical and Mathematical Sciences, Ph.D., 01.05.01, Asso- ciate Professor	1. Mathematical modeling and analysis of dy- namic systems (33 hours)	1. Киселева Е.М., Коряшкина Л.С. Модели и методы оптимального разбиения множеств: линейные, нелинейные, динамические задачи: Монография. – К.: Наук. дум-	2010, Dnipropetrovsk National University, department of training, specialty «Pedagogy of the

				<p>of the department of Computational mathematics and Mathematical cybernetics, Dissertation subject «Methods of optimal splitting of sets in distributed control systems problems», 2000</p>	<p>ка, 2013.–606с.  2. Киселева Е.М., Коряшкина Л.С., Шевченко Т.А. О решении динамической задачи оптимального разбиения множеств с размещением центров подмножеств // Кибернетика и системный анализ. – 2014. – № 6.  3. Киселева Е.М. Непрерывные задачи оптимального разбиения множеств и r-алгоритмы: Монография / Е.М. Киселева, Л.С. Коряшкина. – К. : Наук. думка, 2015. – 400 с.  4. Koriashkina L.S. One way to solve problems of multi-zone dynamics models identification / L.S. Koriashkina, A.V. Pravdivy, A.P. Cherevatenko // Power Engineering, Control &amp; Information Technologies in Geotechnical Systems / CRC Press/ Balkema – Taylor &amp; Francis Group. – 2015. – P. 153 – 160.  5. Киселева Е.М. Теория непрерывных задач оптимального разбиения множеств как универсальный математический аппарат построения диаграммы Вороного и ее обобщений. Часть 1. Теоретиче-</p>	<p>higher school»</p>
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						ские основы / Е. М. Киселева, Л. С. Коряшкина. // Кибернетика и системный анализ. – 2015. – Т. 51, № 3. – С. 3 – 15 с.  Відповідальний секретар щорічної Міжнародної науково практичної конференції «Математичне та програмне забезпечення інтелектуальних систем» (до вересня 2015 року) Член спеціалізованої ради із зіхисту кандидатських дисертацій за спеціальністю 01.05.01 теоретичні основи інформатики та кібернетики (з 2008 до 2015 рік)	
10.	Odnovol Mykola Mykola-jovych	Associate Professor of System Analysis and Management Department	Dnipropetrovsk Mining University 1979, «Automation and telemechanics»			Currently working on dissertation subject: «Research and development of automatic control system for technological processes of coal extraction»	Ukrainian State University of Chemical Technology, department of Information Systems БТКН and I 19 May-19 June 2014., order №227, subject «Mathematical economics»

11.	Malienko Andriy Viktorovich	Assistant Professor of System Analysis and Management Department	National Mining Academy of Ukraine, 2000 p. specialty «Automated control of technological processes and production», Specialist Diploma with Honors, qualification «mining engineer of automation»			<p>1. «Моделирование оценки надежности системы технического обслуживания оборудования угольных шахт .» Malienko A.V. Украина, Днепропетровск, ГБУЗ «Национальный горный университет».Збірнику Гірничя електромеханіка та автоматика 2011г</p> <p>2. Slesarev V. V. Malienko A.V.Разработка метода расчета оперативных графиков работы горнотранспортной сети // Системные технологии. Региональный межвузовский сборник научных работ.- Выпуск 5 (88). - Днепропетровск, 2013. - С.110 - 116.</p> <p>3. Slesarev V. V. Malienko A.V.Управления транспортом на угольной шахте при использовании системы расчетного обоснования. Национальный горный университет. Науковий вісник.- Выпуск (1). - Днепропетровск, 2014. - С.62 -66.</p> <p>4. Средства диспетчеризации и контроля на угольных шахтах. Malienko A.V.. X-я Международная конференция «Проблемы использования информационных технологий в сфере образования, науки и промышленности» (30-31 янв. 2013); Сб. науч. Тр. Нац.</p>	Dnipropetrovsk National University, department of mathematical software of computers from 17.12.2010 to 18.01.2011.
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					<p>Горн .ун-та / редкол.: ГГ Пивняк [и др.]- Д.: Национальний горний університет, 2013. - №1. стр 62-63.</p> <p>5. Алгоритм управления производственным комплексом на основе технологии расчетного обоснования диспетчеризации угольных шахт. Malienko A.V., Slesarev V. V. XI-я Международная конференция «Проблемы использования информационных технологий в сфере образования, науки и промышленности» (26-27 февраля 2014); Сб. науч. Тр. Нац. Горн .ун-та / редкол.: ГГ Пивняк [и др.]- Д.: Национальний горний університет, 2014.</p> <p>The Ph.D. Thesis is prepared: «Development of a system for managing the decision-making process by the coal mine manager»</p>	
12.	Shevchenko Yulija Oleksandrivna	Assistant Professor of System Analysis and Management Department	<p>National Mining Academy of Ukraine, 2001 «Information management systems and technologies»</p> <p>Programmer engineer with the research activity of the instructor of a higher</p>		<p>1) Новицкий И.В., Шевченко Ю.А "Адаптивная система управления процессом крупнокускового дробления" Наук.- техн. збірник «Гірничя електромеханіка та автоматика», випуск №88</p> <p>2) Новицкий И.В., Шевченко Ю.А «Разработка и исследование адаптивной системы управления загрузкой барабанных мельниц» / Збірник наукових праць "XI</p>	<p>Internship program at the Department of Computer Science and Applied Mathematics. Ukrainian State University of Chemical Technology, (19.12.2011-16.01.2012)</p>

			institution, a master's degree with honors			МІЖНАРОДНА КОНФЕРЕНЦІЯ З ПРОБЛЕМ ВИКОРИСТАННЯ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ В ОСВІТІ, НАУЦІ ТА ПРОМИСЛОВОСТІ". - Д.: ДВНЗ «Національний гірничий університет», 2014.	
13.	Kozyr Svitlana Vasylivna	Assistant Professor of System Analysis and Management Department	Artem Dnipropetrovsk Mining Institute, 1989, specialty «Electric drive and automation of industrial plants», qualification: Electrical Engineer			<p>1. Функциональная структура системы связанного управления непрерывными технологическими объектами(4-а міжнародна науково-технічна конференція «Інформаційна техніка та електромеханіка(ІТЕМ-2007)»Тези доповідей 17-19 квітня 2007 року, Луганськ Україна, с.117</p> <p>2. Алгоритмическая структура процессов выбора целевой ситуации и принятия управляющих решений подсистемы принятия решений в составе системы связанного управления непрерывными технологическими объектами( Пятая Международная научно-практическая и методическая конференция «Информационные технологии в сфере дистанционного образования, международного сотрудничества и интеграции образования, науки и производства».</p>	<p>Ukrainian State University of Chemical Technology Department of computer science and applied mathematics. The internship program and the report on its implementation. Subject «Modeling business processes».20.01.2012.</p>

						Тезиси докладов 23 –25 мая 2007года, Днепропетровск, Украина, с.49-50) Ph.D.Thesis «System of connected management of mining enterprises» is in preparation.	
14.	Garanzha Dmytro Mykolajovych	Assistant Professor of System Analysis and Management Department	Dnipropetrovsk Mining Institute, 2007, System Analysis and Management, master degree			<p>1. Zheldak T. A. Оптимальне однови́рне розкrhoювання матеріалу у прокатному виробництві / Zheldak T. A., Garanzha D.M. // Металлург. и горноруд. пром-сть. — 2009. — N 4. — С. 43-46. — Бібліогр.: 7 назв. — укр.</p> <p>2. Garanzha D.M. Факторний аналіз впливу технологічних параметрів процесу гарячої прокатки на довжину розкату і побудова прогнозуючої моделі / Garanzha D.M., Zheldak T. A., М.В. Краєв // Металлург. и горноруд. пром-сть. — 2011. — N 1. — С. 44-49. — Бібліогр.: 9 назв. — укр.</p> <p>3. Zheldak T. A., Системний аналіз факторів, що визначають мірність сортового прокату та шляхи мінімізації немірної продукції / Zheldak T. A., Garanzha D.M.// Науковий вісник НГУ, №8. – Д.: Національний гірничий університет, 2009. – с. 73-77.</p> <p>Slesarev V. V. Оптимізація розкrhoювання продукції прокатного виробництва з використанням методу пошуку із заборонами / Slesarev V. V. Zheldak T. A. ,, Garanzha D.M., Станіна О.Д. // Збірник наукових праць НГУ. – 2010. - № 35, т.2 – с. 41-50.</p>	Graduate school at State HEI "National Mining University» 2008-2011, internship at Ukrainian State University of Chemical Technology, Department of Computer Information Systems, January - February 2017

					<p>4. Slesarev V. V. Застосування тензометричних датчиків в системі прийняття рішень керування сортопрокатним виробництвом / Slesarev V. V. Zheldak T. A., Garanzha D.M. // Системні технології. Регіональний міжвузівський збірник наукових праць. – 2012. - №4(81). – с. 142–150.</p> <p>5. Підвищення ефективності виробництва сортового прокату шляхом збільшення довжини передільних заготовок / Д.М. Гаранжа, Zheldak T. A., // Системний аналіз та інформаційні технології: Матеріали міжнародної науково-технічної конференції SAIT 2010, Київ, 25-29 травня 2010 р. – К.: ННТ «ПСА» НТУУ «КПІ», 2010. – с. 237.</p> <p>6. Garanzha D.M. Розв’язання задачі одновимірного розкроювання за допомогою метаевристичних алгоритмів /Гаранжа Д.М., Zheldak T. A., // Системний аналіз. Інформатика. Управління (SAIU-2012): матеріали III міжнар. наук.-практ. конф., Запоріжжя, 14-16 берез. 2012 р. – Запоріжжя: КПУ, 2012. – с. 107-109.</p> <p>7. Експертна система статистичного контролю механічних властивостей прокатної продукції / Zheldak T. A., Garanzha D.M.// VII міжнародна школа-семинар. Теорія прийняття рішень: матеріали, Ужгород, 29 вересня - 4 жовтня. 2014 р. – Ужгород: УжНТУ, 2014. – с. 107-108.</p>	
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						Працює над завершенням кандидатської дисертації на тему «Система підтримки прийняття рішень в задачах управління процесом прокатки металів» за спеціальністю 05.13.07 - «Автоматизація процесів керування»	
15.	Cherevatenko Antonina Pavlivna	Assistant Professor of System Analysis and Management Department	Dnipro National Mining University, 2013p. specialty – System analysis. qualification – master of System Analysis and Management			<p>1.Koriashkina L.S. Continuous problems of optimal multiplex-partitioning of sets without constraints and solving methods / L.S. Koriashkina, A.P. Cherevatenko // Journal of Computational &amp; Applied Mathematics. – 2015. – № 2 (119). – P. 15 – 32.</p> <p>2.Cherevatenko A. On solutions properties of continuous linear problems of optimal multiplex-partitioning of sets without constraints / A. Cherevatenko // Proceedings of the 5th International youth science forum “Litteris et Artibus”, 26 – 28 November 2015. – Lviv: Lviv Polytechnic Publishing House, 2015. – С. 22 – 25</p> <p>3.Коряшкіна Л.С. Непрерывные линейные задачи оптимального мультиплексного разбиения множеств с ограничениями / Л.С. Коряшкіна, А.П. Череватенко // Вісник Харківського національного університету імені В. Н. Каразіна, Серія «Мат.модельовання. Інформаційні технології. Автоматизовані системи управління», 20</p>	Graduate school at Dnipropetrovsk National University 2013 – 2015 specialty 01.05.01 Theoretical Basics of Informatics and Cybernetics, internship at State HEI "National Mining University» 2016-2017, specialty 05.13.06 Information Technology

						<p>1 5. – Вип. 2 8. – С. 77 – 91.</p> <p>4.Коряшкіна Л.С., Череватенко А.П. Комп'ютерна програма "Optimal multiplex-partitioning of sets" (OMPS-2015) / Свідомство про реєстрацію авторського права № 64326 на твір комп'ютерна програма "Optimal Multiplex-Partitioning of Sets" (OMPS-2015). Дата реєстрації 01.03.2016</p> <p>5.Koriashkina L.S. The continuous problems of the optimal multiplex partitioning an application of sets / L.S. Koriashkina, A.P. Cherevatenko, O.O. Mykhalova // Power Engineering and Information Technologies in Technical Objects Control: 2016 Annual Proceedings November 15, 2016 by CRC Press. – 300 p. – P. (ISBN 9781138714793 - CAT# K32238)</p>
Persons who work part-time						
no						

## APPENDIX 7.2

### 1. Correspondence of the teacher's specialty to the discipline

Kupenko Olha

(Teacher's full name)

Name of the discipline (number of lecture hours)	Спеціальність, рівень підготовки	Correspondence information	Conclusion (corresponds, does not correspond, partially corresponds)
The game theory in the study of conflict situations	124 (master) System analysis	1) correspondence according to documents on higher education - Dnipropetrovsk National University, 2006, specialty "Statistics", qualification of master's degree, diploma No. HP 30585771	corresponds
		2) correspondence according to the documents on the degree - candidate of physical and mathematical sciences, 01.05.04 - "System analysis and optimal solutions theory", diploma DK № 066285 of January 26, 2011, topic of the dissertation: "Qualitative analysis of one class of optimization problems for nonlinear elliptic systems"	corresponds
		Doctor of Physics and Mathematics, 01.05.01 - "Theoretical Foundations of Informatics and Cybernetics", diploma DD № 007125 dated 12.12.2017, topic of the dissertation: "Approximation of optimization problems for nonlinear elliptic systems with degenerate and singular coefficients"	
		3) correspondence according to the documents on the academic rank - associate professor at the department of system analysis and management, certificate 12DC № 034905 from 25.04.2013.	corresponds
		4) correspondence due to scientific specialty - 01.05.04-System analysis and optimal solutions theory	corresponds
		5) Correspondence to the experience of practical work in the specialty - Professor of the Department of System Analysis and Management from 06.01.2018	corresponds
		6) passing of the corresponding scientific-pedagogical internship and availability of three individual publications on this discipline: 1. Scientific activity as a guest professor at the University of Salerno (Italy) document dated 07/11/2016.	Partially corresponds
Logistics fun-	124 (master)	7) Presenting the published textbook or textbook on this discipline - methodical instructions for the course "Theory of games in conflict situations study", 2011 Co-author - Reva V.N.	corresponds
		1) correspondence according to documents on higher	corresponds

damentals	System analysis	education - Dnipropetrovsk National University, 2006, specialty "Statistics", qualification of master's degree, diploma No. HP 30585771	
		2) correspondence according to the documents on the degree - candidate of physical and mathematical sciences, 01.05.04 - "System analysis and optimal solutions theory", diploma DK № 066285 of January 26, 2011, topic of the dissertation: "Qualitative analysis of one class of optimization problems for nonlinear elliptic systems"	corresponds
		Doctor of Physics and Mathematics, 01.05.01 - "Theoretical Foundations of Informatics and Cybernetics", diploma DD № 007125 dated 12.12.2017, topic of the dissertation: "Approximation of optimization problems for nonlinear elliptic systems with degenerate and singular coefficients"	
		3) correspondence according to the documents on the academic rank - associate professor at the department of system analysis and management, certificate 12DC № 034905 from 25.04.2013.	corresponds
		4) correspondence due to scientific specialty - 01.05.01- Theoretical Foundations of Informatics and Cybernetics	corresponds
		5) Correspondence to the experience of practical work in the specialty - Professor of the Department of System Analysis and Management from 06.01.2018	corresponds
		6) passing of the corresponding scientific-pedagogical internship and availability of three individual publications on this discipline: 1. Scientific activity as a guest professor at the University of Salerno (Italy) document dated 07/11/2016.	Partially corresponds
		7) Presenting the published textbook or textbook on this discipline – no textbook	Does not correspond

**Conformity of specialty of the lecturer's discipline is determined by:**

conformity according to documents about higher education;

**or** documents about scientific degree;

**or** documents about academic rank;

**or** scientific specialty;

**or** practical experience for the relevant specialty at least five years;

**or** passing of the corresponding scientific-pedagogical internship lasting at least six months and availability of three individual publications from this discipline in reviewed overseas or professional scientific editions of Ukraine;

**or** availability of a published textbooks on this discipline according to requirements of MES (Ministry of Education and Science).

**Level of scientific and professional activity scientific-pedagogical (scientific) workers**

Kupenko Olha\_

1. Kogut (Kupenko) O.P. Optimization in nonlinear elliptic problems / O.P. Kogut (Kupenko), P.I. Kogut, O.A. Ryadno. – Dnipropetrovsk: DDFA, 2010. – 238 p. (In Ukrainian)
2. D'Apice C. On Shape Stability of Dirichlet Optimal Control Problems in Coefficients for Degenerate Equations of Monotone Type: Shape Stability and Attainability Problems / C. D'Apice, U. De Maio, O.P. Kogut (Kupenko) // SIAM. Journal of Control and Optimization. – 2012. – Vol. 50. – № 3. – pp. 1174-1199.
3. Kupenko O.P. On an Optimal L1-Control Problem in Coefficients for Linear Elliptic Variational Inequality / O.P. Kupenko, R. Manzo // Abstract and Applied Analysis. – 2013. – Vol. 2013. – Article ID 821964. – 13 p. DOI: 10.1155/2013/821964
4. Kupenko O.P. On Existence and Attainability of Solutions to Optimal Control Problems in Coefficients for Degenerate Variational Inequalities of Monotone Type / O.P. Kupenko // Continuous and Distributed Systems. Series: Solid Mechanics and Its Applications 211. – Warsaw: Springer, 2013. – pp. 287-301. DOI: 10.1007/978-3-319-03146-0
5. Kupenko O.P. On Optimality Conditions for Optimal Control Problem in Coefficients for  $\Delta p$ -Laplacian / O.P. Kupenko, R. Manzo // Boundary Value Problems. – 2014. – Vol. 72. – pp. 1-29. – Режим доступу:  
<http://www.boundaryvalueproblems.com/content/2014/1/72>.
6. Kogut P.I. Optimal Control Problems in Coefficients for Nonlinear Dirichlet Problems of Monotone Type: Optimality Conditions. Part I / P.I. Kogut, O.P. Kupenko, G. Leugering // Zeitschrift für Analysis und ihre Anwendungen. – 2015. – Vol. 34. – Issue 1. – pp. 85-108. DOI: 10.4171/ZAA/1530
7. Kogut P.I. Optimal Control Problems in Coefficients for Nonlinear Dirichlet Problems of Monotone Type: Optimality Conditions. Part II / P.I. Kogut, O.P. Kupenko, G. Leugering // Zeitschrift für Analysis und ihre Anwendungen. – 2015. – Vol. 34. – Issue 2. – pp. 199-219. DOI: 10.4171/ZAA/1536
8. Kupenko O.P. On Existence of Weak Optimal Controls in Coefficients for Degenerate Anisotropic p-Laplacian / O.P. Kupenko, G. Leugering // Continuous and Distributed Systems II. Series: Studies in Systems, Decision and Control 30. – Warsaw: Springer, 2015. – pp. 315-337. DOI: 10.1007/978-3-319-19075-4\_19
9. Kupenko O.P. Optimal Control Problems in Coefficients for Coupled System of Hammerstein Type / O.P. Kupenko, R. Manzo // Discrete and Continuous Dynamic Systems. Series B. – 2015. – Vol. 20. – № 9. – pp. 2967-2992.
10. Kogut P.I. On Optimal L1-Control in Coefficients for a Degenerate Nonlinear Elliptic Equation. Optimality Conditions / P.I. Kogut, O.P. Kupenko // Advances in Dynamical Systems and Control. Series: Studies in Systems, Decision and Control 69. – Warsaw: Springer, 2016. – pp. 429-471. ISBN 978-3-319-40673-2
11. Kupenko O.P. Approximation of an Optimal Control Problem in the Coefficient for Variational Inequality with Anisotropic p-Laplacian / O.P. Kupenko, R. Manzo // Nonlinear Differential Equations and Applications. – 2016. – Vol. 23. – Issue 3. – 18 p. DOI: 10.1007/s00030-016-0387-9
12. Durante T. On Attainability of Optimal Controls in Coefficients for System of Hammerstein Type with Anisotropic p-Laplacian / T. Durante, O.P. Kupenko, R. Manzo // Ricerche di Matematica. – June 24, 2016. – 32 p. DOI:10.1007/s11587-016-0300-1

## II

1. Kupenko O.P. Variational Inequalities of Monotone Type. II. Attainability Problem / Kupenko O.P. // Journal of Applied and Computational Mathematics – 2012 (107) – № 1. – P. 15-34.
2. Zadoyanchuk N.V. On the solvability of one class of optimal control problems for degenerate elliptic variational inequalities / Zadoyanchuk N.V., Kupenko O.P. // Journal of Applied and Computational Mathematics – 2013 (114). – № 4. – P. 10-23. (In Ukrainian)

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3. Kupenko O.P. Shape Stability of Optimal Control Problems in Coefficients for Coupled System of Hammerstein Type / O.P. Kupenko, P.I. Kogut // DNU Bulletin. Series: Modelling. – 2014. – Issue 5. – № 8. – P. 55-87.
  4. Kogut P.I. On Henig Regularization of State-Constrained Optimal Control Problem for the p-Laplace Equation/ P.I. Kogut, O.P. Kupenko DNU Bulletin. Series: Modelling. – 2015. – Issue 7. – № 8. – P. 57-75.
  5. Kupenko O.P. On Existence of Optimal Controls in Coefficients for Ill-Posed Nonlinear Elliptic Dirichlet Boundary Value Problems with Anisotropic p-Laplacian/ O.P. Kupenko // DNU Bulletin. Series: Modelling. – 2016. – T. 24. – № 8. – P. 108-119.

### III

1. Official opponent, Strakhov E.M., PhD. 01.01.09, Thesis Defence from 10.06.13, Academic Council K41.051.05

2. Official opponent, Pyshnograev I.O., PhD 01.05.04, Thesis Defence 13.10.16, Academic Council Д 26.001.35

### IV

1. Doctor of Physics and Mathematics, 01.05.01 - "Theoretical Foundations of Informatics and Cybernetics", diploma DD № 007125 dated 12.12.2017, topics of the dissertation: "Approximation of optimization problems for nonlinear elliptic systems with degenerate and singular coefficients"

### Notes:

recognized professional with experience in research work on a specialty considered scientific-pedagogical (scientific) worker, which has at least ten years of experience in scientific work at the positions, that meet or are related in content relevant academic discipline;

recognized professional with experience with managerial experience on a specialty considered scientific-pedagogical (scientific) worker, which has at least ten years of experience in scientific work at the positions of head (deputy heads) enterprises (organizations and institutions), their divisions, which involve direct management of employees, who work in professions, which responsible or are related in content relevant academic discipline;

recognized professional with experience the experience of innovation on a specialty considered scientific-pedagogical (scientific) worker, which has at least ten years of experience in scientific work, aimed at creating objects of intellectual property rights (inventions, useful models, industrial designs, composing (topographies) integral microcircuits, innovative proposals, varieties of plants, animal breeds, scientific discoveries, computer programs, compilation of data (without data), their use and commercialization;

recognized professional with experience with practical experience on a specialty considered scientific-pedagogical (pedagogical) worker by profession, corresponding or related to the content of the relevant discipline. This experience also includes work on the positions of head (deputy heads) enterprises (organizations and institutions), their divisions, which involve direct management of employees, who work in professions, which responsible or are related in content relevant academic discipline

## APPENDIX 8.1

### Provision of Educational Facilities and Other Premises

№	Name of premise	Area of the premises (square meters)			
		at all	Including		
			own	leased	for rent
1	Educational facilities, including all	53 317,1	53 317,1	—	—
2	premises for students, cadets, listeners (lectures, auditoriums, offices, laboratories, etc.)	50 566,7	50 566,7	—	—
3	computer laboratories	381,4	381,4	—	—
4	sports halls	2 369,0	2 369,0	—	—
5	Premises for scientific and pedagogical workers	4 311,0	4 311,0	—	—
6	Service rooms	3 342,0	3 342,0	—	—
7	Library, including reading rooms	1 666,0 342,0	1 666,0 342,0	— —	— —
8	Hostels	46 441,0	46 441,0	—	—
9	Canteens, buffets	2 996,9 899,6	2 996,9 899,6	— —	— —
10	Profilaktoriy, bases of rest	1 615,0 —	1 615,0 —	— —	— —
11	Medical items rooms	16,7	16,7	—	—
12	Others	419, 6	419,6	—	—

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## APPENDIX 8.2

### Equipment of Laboratories and Specialized Offices of the Graduation Department of System Analysis and Control.

з/п	Name of laboratories, specialized offices, it's area	List of equipment, machinery, quantity
1	7/1004 «Project development». 51,8м2	Asus Tek P5B-MX/Intel P 4.631/DDR2 1Gb/HDD 160Gb/FDD - 9 ., ПК 10.3 CEL 1.3/256Mb/40Gb/3.5"/32M - 7 .
2	7/1009 «Information Technology». 62,5м2	Server Intel C2 D E8400GS- TD256E/500GB - 1 ., ПК 2 «Лідер» I5-2300/P8H61- M/4Gb/1Tb/DRW500W/Samsung – 3 . Asus V2N68-AM Plus AMD Atlon 64 X2 4200+DDR-800 –3 . Intel PENTIUM – 3 Biostar MCP6P M2 + AMD At lon – 3 o

## APPENDIX 11

### Links for Main Documents of University

№	Document	Link (uk)
1	State license	<a href="http://www.nmu.org.ua/ua/content/study/admission/admission_office/admission_statute.php">http://www.nmu.org.ua/ua/content/study/admission/admission_office/admission_statute.php</a> <a href="https://mon.gov.ua/ua/ministerstvo/poslugi/licenzuvanny-a/vidomosti-pro-pravo-zdijsnennya-osvitnoyi-diyalnosti/dnipropetrovska-oblast-l">https://mon.gov.ua/ua/ministerstvo/poslugi/licenzuvanny-a/vidomosti-pro-pravo-zdijsnennya-osvitnoyi-diyalnosti/dnipropetrovska-oblast-l</a>
2	Regulations regarding the Organization of the Educational Process	<a href="http://www.nmu.org.ua/ua/content/activity/us_document_s/">http://www.nmu.org.ua/ua/content/activity/us_document_s/</a>
3	Regulations on the organization of free choice of students ...	<a href="http://www.nmu.org.ua/ua/content/activity/us_document_s/">http://www.nmu.org.ua/ua/content/activity/us_document_s/</a>
4	The Code of Academic Integrity of State Higher Educational Institution "National Mining University"	<a href="http://www.nmu.org.ua/ua/content/infrastructure/structural_divisions/Internal_quality_higher_education/%D0%9A%D0%BE%D0%B4%D0%B5%D0%BA%D1%81%20%D0%B4%D0%BE%D0%B1%D1%80%D0%BE%D1%87%D0%B5%D1%81%D0%BD%D0%BE%D1%81%D1%82%D1%96.pdf">http://www.nmu.org.ua/ua/content/infrastructure/structural_divisions/Internal_quality_higher_education/%D0%9A%D0%BE%D0%B4%D0%B5%D0%BA%D1%81%20%D0%B4%D0%BE%D0%B1%D1%80%D0%BE%D1%87%D0%B5%D1%81%D0%BD%D0%BE%D1%81%D1%82%D1%96.pdf</a>
5	Regulations on professional development and training	<a href="http://www.nmu.org.ua/ua/content/activity/us_document_s/">http://www.nmu.org.ua/ua/content/activity/us_document_s/</a>
6	Regulations on the procedure for carrying out the replacement of competitive selection of vacant positions of scientific and teaching staff	<a href="http://www.nmu.org.ua/ua/content/activity/us_document_s/">http://www.nmu.org.ua/ua/content/activity/us_document_s/</a>
7	The rules of time for planning and accounting of educational, methodological, scientific and organizational work of scientific and pedagogical workers of the state higher educational institution "National Mining University"	<a href="http://www.nmu.org.ua/ua/content/activity/us_documents/%D0%9D%D0%9E%D0%A0%D0%9C%D0%98%20%D0%A7%D0%90%D0%A1%D0%A3%20%D0%97%20%D0%9F%D0%9B%D0%90%D0%9D%D0%A3%D0%92%D0%90%D0%9D%D0%9D%D0%AF%20%D0%A2%D0%90%20%D0%9E%D0%91%D0%9B%D0%86%D0%9A%D0%A3%20%D0%A0%D0%9E%D0%91%D0%9E%D0%A2%D0%98%20%D0%9D%D0%9F%D0%9F.pdf">http://www.nmu.org.ua/ua/content/activity/us_documents/%D0%9D%D0%9E%D0%A0%D0%9C%D0%98%20%D0%A7%D0%90%D0%A1%D0%A3%20%D0%97%20%D0%9F%D0%9B%D0%90%D0%9D%D0%A3%D0%92%D0%90%D0%9D%D0%9D%D0%AF%20%D0%A2%D0%90%20%D0%9E%D0%91%D0%9B%D0%86%D0%9A%D0%A3%20%D0%A0%D0%9E%D0%91%D0%9E%D0%A2%D0%98%20%D0%9D%D0%9F%D0%9F.pdf</a>
	Quality assurance policy	<a href="http://www.nmu.org.ua/ua/content/infrastructure/structural_divisions/Internal_quality_higher_education/%D0%9F%D0%BE%D0%BB%D1%96%D1%82%D0%B8%D0%BA%D0%B0%20%D1%8F%D0%BA%D0%BE%D1%81%D1%82%D1%96%20%D0%9D%D0%93%D0%A3.pdf">http://www.nmu.org.ua/ua/content/infrastructure/structural_divisions/Internal_quality_higher_education/%D0%9F%D0%BE%D0%BB%D1%96%D1%82%D0%B8%D0%BA%D0%B0%20%D1%8F%D0%BA%D0%BE%D1%81%D1%82%D1%96%20%D0%9D%D0%93%D0%A3.pdf</a>