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

Department of System Analysis and Control

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WORKING PROGRAM OF EDUCATIONAL DISCIPLINE
«Integrated Management Systems»
For masters of specialty 124 «System Analysis»

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CONTENT

INTRODUCTION

Results of the Master's program from 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 "Integrated Management Systems" includes the following competencies and learning outcomes:

FC18 - Ability to implement effective algorithms in production and technological activities in solving problems of system analysis and designing decision support systems;

FC10 - Ability to use modern information technologies in solving problems of system analysis .;

PRN7 - Know the methods of forecasting the dynamics of processes of different nature, be able to develop prediction functions;

PRN 12 - Ability to search information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources;

PRN 30 - Analyze the stability of dynamic systems, 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 course, the Master must master the following general learning outcomes:

ZRN 2 Ability to search information in specialized literature in the field of system analysis using a variety of resources: journals, databases, on-line resources.

ZRN 3 Ability to process, analyze, systematize scientific and technical information, generalize advanced national and foreign experience in system analysis.

ZRN 4 To develop and apply in the professional activity their creative abilities, to organize a workplace, to plan working hours

ZRN 5 Show curiosity, risk aversion, ability to think, inspire new ideas, incarnate them, ignite them, combine and experiment

The purpose of the discipline "Integrated Management Systems" is to familiarize students with modern methods of creating integrated management systems and to give the skills of using the means of analysis and synthesis of such systems, providing learning outcomes related to the analysis of dynamic systems in accordance with the educational-professional program.

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 specialists training;
- the 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 for the structure and content of individual tasks;
- tasks for 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 master's degree in specialty 124 "System analysis" / Ministry of Education and Science of Ukraine, National Academy of Sciences of Ukraine. mountain un - 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 dated December 30, 2015, No. 1187 «Licensing conditions for the educational activities of educational institutions».

2.3 Draft Standard of Higher Education Masters of Specialty 124 system analysis.

2.4 Law of Ukraine «On Higher Education».

2.5 The standard of higher education of the State Higher Educational Institution «NMU» Designing the educational process. Dnipropetrovsk: NMU, 2016. - 74 p.

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 10th semester, in the 19th (9th week) and the 20th quarter (8 weeks).

4 Denomination of physical quantities

W(p) – transmitting function;

$h(t)$ – weight function of the link (impulse transition function);

H(t) – transient function of the link;
$A(\omega)$ – amplitude frequency response (AFC);
$\varphi(\omega)$ – phase frequency response (FHC).

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 (DRN)
1	2
PRN7 - Know the methods of forecasting the dynamics of processes of different nature, be able to develop prediction functions;	DRN7-1 Compose mathematical models of SC.
	DRN7-2 Perform the transformation of the mathematical models of the SC.
	DRN7-3 It is reasonable and appropriate to use standard quality control indicators.
PRN 12 - 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 perturbations, using the measured signals of the input and output coordinates of the object;	DRN12-1 To form mathematical models of SK, to be able to convert them mutually. Be able to transform the structural schemes of the SC.
	DRN12-2 It is reasonable and appropriate to use standard quality control indicators.
	DRN12-3 Investigate SC on controllability and observation.
	DRN12-4 Know the basic methods of synthesis of SC.
	DRN12-5 Be able to carry out research on the motion of control systems on a phase plane.
	DRN12-6 Know the methods of analyzing the stability of control systems
	DRN12-7 Ability to determine the basic dynamic characteristics of the SC, apply modern methods of analysis of the SC to manageability and observability.
PRN 30 - Analyze the stability of dynamic systems, apply stochastic	DRN30-1 Know the methods of analyzing the stability of control systems.

regression models and models in the state of space to describe the dynamics of processes of different nature.	DRN30-2 Investigate SC on sensitivity.
	DRN30-3 Know the basic methods of synthesis of SC.
	DRN30-4 Perform synthesis of control system parts by frequency response methods, root hodograph and corrective devices.
	DRN30-5 Perform an analytical study of the stability of linear systems, apply corrective devices for the synthesis of SC.
	DRN30-6 Calculate the basic parameters of digital control systems.

6 Thematic plan and distribution of the volume of discipline by types of training sessions

DRN code	**Kind and theme of training sessions**	**Amount,** *hours*		
		aud	**CPC**	**total**
1	**2**	**3**	**4**	**5**
	lectures	**18**	**27**	**45**
DRN7-1	1. Introduction. Subject and content of the course.	1	2	3
DRN7-1, DRN7-2	2. The task of the material discovery.	1	2	3
	3. Event recognition algorithm.	1	2	3
DRN12-1	4. Requirements for ISU.	1	1	2
DRN12-1	5. Structural ISU schemes.	2	1	3
DRN7-3, DRN12-2	6 Systemic tasks in the ISU	2	1	3
DRN12-2	7. Composition and appointment of the elements of the ISU	2	2	54
DRN7-1, 2	8. ISU software and hardware unit	1	2	3
DRN12-5	9. Principles of building an ISU	1	2	3
DRN12-6, DRN30-1	10. The ISU design procedure	1	2	3

DRN12-6	11. Implementation of the ISU. Economic feasibility of the ISU	1	2	3
DRN30-2	12. Methodology for the construction of automated systems.	1	2	3
DRN30-3	13 Categorical notions of system analysis of automated systems	1	2	3
DRN30-3	14. Models of analysis of the structure of the ACU.	1	2	3
DRN30-3	15 Final lecture	1	2	3
	Laboratory work	**18**	**27**	**45**
DRN12-1	1. Models of analysis of the structure of the ACU.	2	3	6
DRN12-1	2. Models of synthesis of the structure of the ACU.	2	3	8
DRN12-7	3. Models and decision-making process in ACU.	2	3	9
DRN12-5	4. Types of automated control.	2	3	9
DRN12-5	5. Automated control systems	2	3	9
DRN30-5	6. Automated enterprise management systems	2	3	9
DRN30-5	7. Provide automation control subsystems..	2	3	9
DRN30-6	8. Authorization and manipulation in management processes.	2	3	9
DRN30-4, DRN30-5	9. Composition and destination of components in real-time systems.	2	3	8
	Total	**36**	**54**	**90**
	Lectures (classroom - 1 hour per week)	**36**	**54**	**90**
	Laboratory work (classroom - 1 hour per week)	**36**	**54**	**90**
	Final (semester) control – exam: **10 semester, 20 quarter**			

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 training;
2) development of the ability to apply discipline knowledge to develop specific solutions in control systems.
3) acquisition of the skills of calculating the parameters of the control system.

In view of the task to carry out the following operations:
1) make a mathematical model of the control object;
2) solve an extreme task;
3) determine the optimal control effect that provides the specified characteristics of the control object.

When evaluating the task is taken into account:

• used methods;
• correctness and completeness of solving tasks;
• literacy, conciseness and logical sequence of presentation;
• the 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 independent work of the student

The main tasks for independent work include:
• preliminary processing of information provision for each topic;
• preparation for ongoing control - solving tasks of self-control on each topic;
• performance of individual tasks;
• 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

Form of final control - exam.

An assessment of the level of the formation of disciplinary competencies in the form of examinations can also be carried out without the participation of a student based on the results of 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 taken;
- Teach material on paper Logically, consistently, with the requirements of 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 performed tasks is carried out by comparing them with the standards - samples of correct and complete answers through identifying the level of the formation of competencies 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
Scale 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 material presentation;
- compliance of the report with 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 evaluation of achievements in all laboratory work is accepted (student achievement level is not less than 60% or at least 60 points) only in the case when all laboratory work provided by the program of the discipline is fulfilled 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 – the level of achievements for the i-th type of occupation, %;

T_i – the 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 by the results of any current control measure is lower than 60%, then the discipline is rated «Fx» and, if below 35%, then «F».

According to the national scale in this case the «uncredited»

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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) task and methodical provision of laboratory work;
4) materials of methodical 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. Alexander A.G. Optimal and adaptive systems: Textbook. allowance for higher education institutions. M .: ext. pc., 1989. - 263 pp.
2. Methodical instructions for the fulfillment of individual tasks in the discipline "Modern management theory". / I.V. Novitsky, V.I. Dmitriev, N.N. Odnolol "Science and Education", 2002 – 33p.
3. Novitsky I.V. Contemporary theory of management: teach. manual / I.V. Novitsky, SA Us, Ministry of Education and Science of Ukraine, National. mountain un - Dnipro: NMU, 2017. - 263 p.
4. Handbook on the theory of automatic control, ed. A. A. Krasovskii. - Moscow: Science, 1987. - 712 p.

11.2 Additional

5. The theory of automatic control, ed. A.A. Voronova - Moscow: Vysshishk 1986 – 368p .;
6. Popov E.P. Theory of linear systems of automatic regulation and control. - Moscow: Nauka, 1989. – 304p.
7. Erofeev A.A. The theory of automatic control: Textbook for high schools. - 3rd ed., Stereotype. - SPb .: Polytechnic, 2008.- 302p.
8. Modern management systems / R. Dorf, R. Bishop. per. from english B.I. Kopylova - M .: Laboratory of Basic Knowledge, 2002. - 832p.

9. Churakov E.P. Optimal and adaptive systems: study. allowance for higher education institutions. - Moscow: Energoatomizdat, 1987. – 256p.
10. Synthesis of optimal and adaptive control systems. Game approach / Kuntsevich V.M., Lychak M.M. - Kiev: Sciences. thought, 1985. – 248p.
11. Pospelov D.A. Situation Management: Theory and Practice. - M .: Science. - Gl. Ed. phys.-mate lit., 1986.- 288p.

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