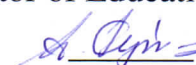Ministry of Education and Science of Ukraine
National Aerospace University
"Kharkiv Aviation Institute"

Department of Aircraft Control Systems

APPROVED:

Guarantor of Educational Program

A. Сyn A. S. Kulik

" 27 " 08 2021

WORK PROGRAM OF THE COMPULSORY DISCIPLINE

Master Research Work

Branch of Education: 17 − Electronics and Telecommunication

Training Direction: 173 − Avionics

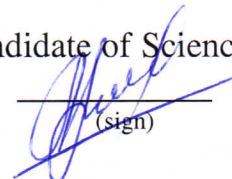Specialty: Systems of Autonomous Navigation and Adaptive Control of Aircrafts

Education Level: 2nd (Master degree)

Kharkiv 2021

The developed program on course «Master Research Work» is for English-speaking students of training direction 173 – "Avionics", specialty "Systems of Autonomous Navigation and Adaptive Control of Aircrafts"

«27» 08 2021, 8 p.

Developer Zymovin A,Ya., Associate professor of dept. 301, Candidate of Science (Engineering) _____
(sign)

Course syllabus has been accepted at the meeting of dept. 301 «Aircraft Control Systems».

Meeting record № 1 on " 27 " August 2021

Head of department
Candidate of Science (Eng), Associate Professor _____ K. Dergachov
(sign)

1. Course description

Indices	Branch of education, learning direction, education level	Course specification
		Full-time study
ECTS credits – 5	Branch of Education: 17 – Electronics and Tele-communication	Professional training area
Modules – 1		
Semantic modules – 2		Calendar year
Research into the topic _____ (topic name)	Training Direction: 173 – Avionics	2021-2022
		Semester
		9
Total hours – 150	Specialization: Systems of Autonomous Navigation and Adaptive Control of Aircrafts	Lectures
Academic hours per day for full-time study		–
Semester 9		Tutorials [1]
classroom 2 hrs.	self-study 8 hrs.	30
		Lab classes
		–
		Self-study (unaided) work
	Education level: 2nd (masterr degree)	120
		Assessment form
		Test

[1] depending on timetable, classroom studies can decrease or enlarge by one hour in a week

Note: ratio of classroom working and unaided (self-study) work makes:
30/120 (under full-time education).

2. Purpose and objectives of academic discipline

Learning Aims is students' creative activity development while implementing research.

Training objectives – broader reading and analyzing scientific and engineering books, and patent sources on the topic of master's final qualification work; acquiring skills of structured analysis of scientific research in written form; strengthening skills in public speaking and implementing some teaching activities.

Learning Outcomes
On successful completion of the subject, students

should know:
– basic scientific ground of subjects associated with mathematical description of processes running in complex dynamic systems,
– fundamental tools of processing various information flows,
– the basics of modern technology for gathering, processing and presenting information,
– the nature and the structure of processes in educational area,
– methodology for scientific research and experimentation,
– norms of a collective communication,
– instruments of professional self-knowledge and self-development;

should be able to:
– formulate and solve problems that arise during the research activity and require deepening of professional knowledge,
– select the necessary research methods, modify the noble and develop new methods, proceeding from the objectives of the particular study,
– submit, following the requirements, the work reports done in the form of abstracts, articles, patents for a utility model or invention, methodological instructions for laboratory and practice classes,
– understand methodological basics and features of methods used in a development of complex dynamic systems of different physical nature;

have a general notion:
– on ways of concentrating information resources related to professional activity,
– ways professional skills improvement by using opportunities of information environments,
– about self-esteem and self-control intentions.

3. Course syllabus

Module 1

Semantic Modulus 1. The treatment aspects of modern information processes

Topic 1. Approaches to provide the analysis of aims and specific tasks of the thesis
Studying features of the control object, its purpose, structure, operating principle; formulation of particular tasks needed to solve. Searching of key ideas on the control system design; getting known of system functional elements required and specifications referred to system performance.

Topic 2. Development of the plan of works on theme of master's thesis
Acquisition of necessary scientific and technical literature and its analysis. Performing a patent search, selection and justification of analogues and prototypes. In accordance with the tasks and purposes of the graduation work, defining the tasks of research, making a choice of research methods, as well as ways of mathematical description of processes existent within the involved control loops. Elaboration of calendar plan on solving the tasks formulated.

Topic 3. Preparing to a public speaking about implementing stages of the master work

Making reports on the stages of master's work fulfillment: a report on literary and patent research, as well as on a pick and ground of research methods, on running experiments.

Semantic Modulus 2. Skills and masteries enhancement in scientific and pedagogical work

Topic 4. Elaboration of methodology how to run a laboratory work on studying dynamic performance of closed-loop control systems and influencing of system parameters on stability (lab topic #1).

Topic 5. Elaboration of methodology how to run a laboratory work on studying dynamic features of systems using the method of modal control (lab topic #2).

Topic 6. Elaboration of methodology how to run a laboratory work on studying the system dynamic peculiarities appearing due to quantization processes (lab topic #3).

Topic 7. Elaboration of methodology how to run a laboratory work on determining statistical characteristics of control systems (lab topic #4).

Topic 8. Elaboration of methodology how to run a laboratory work on analytical developing the controller (lab topic #5).

Topic 9. Elaboration of methodology how to run a laboratory work on mastering skills of synthesizing parameters of a PID controller (lab topic #6).

Topic 10. Elaboration of methodology how to run a laboratory work on principles of designing fuzzy logic controllers (lab topic #7).

4. Course structure

Semantic modules and topics	Hours					
	total	full-time				part-time
		among them				–
		lectures	tutor	labs	indep.	
1	2	3	4	5	6	7
Module1						
Semantic Modulus 1 – The treatment aspects of modern information processes						
Topic 1. Studying features of the control object. Searching of key ideas on the control system design	9	2	2	–	5	–
Topic 2. Development of the plan of works on the theme of master's thesis	13	1	4	–	8	–
Topic 3. Preparing to a public speaking on implementation of the work	16	2	4	–	10	–
Total for semantic modulus 1	38	5	10	–	23	–
1	2	3	4	5	6	7

Module 1						
Semantic Modulus 2 – Skill and masteries enhancement into scientific and pedagogical work						
Topic4. Lab methodology on studying dynamic performance .	16	2	4	–	10	–
Topic 5. Lab methodology on the method of modal control	16	2	4	–	10	–
Topic 6. Lab methodology on peculiarities caused by quantization processes	16	2	4	–	10	–
Topic 7. Lab methodology on determining statistical characteristics	16	2	4	–	10	–
Topic 8. Lab methodology on analytical developing of controllers	16	2	4	–	10	–
Topic 9. Lab methodology on synthesizing parameters of a PID controller	16	2	4	–	10	–
Topic 10. Lab methodology on principles of designing fuzzy logic controllers	16	2	4	–	10	–
Total for semantic modulus 2	112	14	28	–	70	–
Course total	**150**	**19**	**38**	**–**	**93**	**–**

5. Topics of seminar classes

№ a/o	Topicname	Hours
1	Not appointed	–

6. Topics of tutorials

№ a/o	Topic name	Hours
1	2	3
1	Investigation of problems associated with control system design	3
2	Acquisition of the necessary scientific and technical literature and its analysis completed by understanding its component parts and requirements referred to performance specifications	3
3	Development of the plan of works on the topic. Preparation of the public speaking on work stages	4
4	Putting and solving problems related to lab research purposed to learn dynamic performance of closed-loop control systems	4
5	Putting and solving problems related to lab research purposed to learn dynamic features of systems by using the method of modal control	4
6	Putting and solving problems related to lab research purposed to learn system dynamic peculiarities appearing due to the quantization processes	4
7	Putting and solving problems related to lab research purposed to learn ways of determining statistical characteristics of control systems	4
1	2	3

8	Putting and solving problems related to lab research purposed to learn ways of analytical designing the controller	4
9	Putting and solving problems related to lab research purposed to learn a technique of synthesizing PID controller	4
10	Putting and solving problems related to lab research purposed to learn principles of designing fuzzy logic controllers	4
Total hours		**38**

7. Topics of lab classes

№ a/o	Topic name	Hours
1	Not appointed	–

8. Self-study (unaided) work

№ a/o	Topic name	Hours
1	Familiarizing the topic of master's thesis, studying appropriate scientific and technical literature and its analysis. Carrying out a patent search	5
2	Compiling understanding of control system component parts and requirements referred to performance specifications	8
3	Defining the tasks of research, making a choice of research methods, as well as ways of mathematical description of processes existent within the involved control loops	10
4	Elaboration of methodology how to run the laboratory work on topic #1	10
5	Elaboration of methodology how to run the laboratory work on topic #2	10
6	Elaboration of methodology how to run the laboratory work on topic #3	10
7	Elaboration of methodology how to run the laboratory work on topic #4	10
8	Elaboration of methodology how to run the laboratory work on topic #5	10
9	Elaboration of methodology how to run the laboratory work on topic #6	10
10	Elaboration of methodology how to run the laboratory work on topic #7	10
Total hours		**93**

9. Individual assignments

№ a/o	Topic name	Hours
1	"Analysis and synthesis of digital ACS" (individual tasks refer to a certain control object that was specified for the thesis and designated in the name of the thesis)	
Total hours [1]		

[1] due time hours included in self-study work schedule

10. Teaching methods

Lectures delivering, conducting lab classes, individual consultations (if necessary), independent work of students with tutorials issued by the department (learning the manuals).

11. Forms of control

Current control tests in form of lab report submission, defense of individual assignments corresponding to semantic modules and topics, final quiz, written credit (if necessary).

12. Assignment of grade points obtaining by a student (credit passed)

Current tests and unaided work			Summative test (examination) due to refusing the received current points and intent taking the exam if allowed
Semantic Modulus №1 (weight)	Semantic Modulus №2 (weight)	Grade points total	
T1 – T3	T4 – T10	100	100
30	70		

13. Recommended reading

Basic

1. Кулик А.С., Дыбская И.Ю. Введение в теорию ЦАС.- Х.: Харьк. Авиац. ин-т, 2007.–165с./ Introduction to Digital Automatic Control systems Theory. A. Kulik, I. Dybska. The textbook. – Kharkiv: National Aerospace University, 2007. – 165 p.

2 Nagle T., Chakrabortty A., Phillips C.L. Digital Control System Analysis and Design. London: Pearson, 2014.

3. Kuo Benjamin C. Automatic Control Systems – Englewood Chffs, NJ: Prentice Hill, 1995 – 417 p.

Complementary reading

1. Закон України «Про вищу освіту» (Відомості Верховної Ради) №37-38, 2014. Документ чинний 1556-18, поточна редакція від 01.01.2016р. підстава 911-19.

2 Патентні дослідження. Методичні рекомендації. За ред. В.Л. Петрова. Київ, 1999 р.