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

Department of Aircraft and Rocket Engineering

SCIENTIFIC WORK ON THE TOPIC OF MASTER'S THESIS-1. BASIS OF SCIENTIFIC RESEARCH

Work programme of the academic discipline (Silabus)

Details of the discipline

Level of higher education	*Second (master's)*
Field of knowledge	*13 Mechanical engineering*
Specialty	*134 Aviation and aerospace technologies*
Educational program	*Aviation and aerospace technologies*
Status of the discipline	*Cycle of professional training*
Form of study	*Full-time form of study*
Year of preparation, semester	*1 course, fall srmester*
Scope of the discipline	*60 hours*
Semester control/ control measures	*Credit*
Lessons schedule	*http://rozklad.kpi.ua*
Language of teaching	*Ukrainian/English*
Information about the teacher course leader	*Lecturer: Associate Professor P.V. Lukianov,lvptvl@ukr.net* *Practice: Associate Professor Lukyanov P.V., lvptvl@ukr.net*
Placement course	*https://campus.kpi.ua*

Program of educational discipline

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

This discipline is designed to provide masters with theoretical and practical knowledge of research methodology and techniques, planning and organisation of research, methods of analysis and decision-making based on research results. This will allow them to independently set and creatively solve complex problems of aerodynamics, design and manufacture of aircraft.

1.1. The aim of the discipline is to develop students' competencies:

GC 2. Ability to identify, formulate and solve problems
GC 3. Ability to conduct research at the appropriate level.
GC 6. Ability to adapt and act in a new situation.
GC 8. Determination and perseverance in tasks and responsibilities
PC 1. Awareness of the history, current state, problems and prospects of development of aviation and rocket and space technology.
PC 2. Ability to critically comprehend the problems of aviation and/or rocket and space technology, including on the border with related fields, engineering sciences, physics, chemistry, ecology, economics
PC 5. Ability to create, improve and apply mathematical and numerical methods of

modelling properties, phenomena and processes in systems and elements of aviation and rocket and space technology.

PC 7. Ability to perform engineering and management work to prepare the production of aviation and rocket and space technology using the latest technologies.
- develop physical and mathematical models of systems and processes;

and also:

- implement physical and mathematical models of systems and processes using methods and tools of modern information technology;
- develop joint plans for comprehensive scientific research in cooperation with domestic and foreign scientific and design institutions;
- prepare scientific and technical publications based on the results of the research;
- to organise and conduct research related to the analysis of the properties of air currents in extreme flight conditions, including the use of modern mathematical methods;
- organise and conduct research related to the development and analysis of the properties of advanced composite materials;
- plan the scientific activities of the unit and perform preliminary calculations of the labour intensity and cost of applied scientific research;
- organise and conduct research related to the analysis of frequency characteristics of multi-component elastic structures of aircraft;
- organise and conduct research on the design process of multi-component aircraft structures.

In accordance with the requirements of the educational and professional programme, students must demonstrate the following learning outcomes after mastering the discipline:

knowledge:

- methods of stochastic experiment processing;
- general methods of research planning and expert evaluation of their cost;
- basic laws and legal acts regulating the relationship between scientific organisations at the national and international levels;
- rules of execution of agreements on scientific activities;
- rules for preparing reports on the results of scientific activities;
- frequency of research planning depending on the subject matter and amount of funding;
- basic legislative acts regulating the relations between subjects of scientific and scientific and technical activities, including at the international level;
- rules for the preparation of scientific articles and monographs in domestic and foreign professional publications.

skills:

Skills:

Programme learning outcomes:

PLO 1. To know and understand the principles of basic and engineering sciences underlying aviation and/or rocket and space technology.

PLO 4. To use modern methods of solving inventive problems, to protect intellectual property for technical solutions and other results of professional (scientific and technical) activity.

PLO 6. To make effective decisions in the event of non-standard complex tasks in

professional (scientific and technical) activities in conditions of uncertainty of requirements, the availability of a range of opinions and limited time.
PLO 7. To demonstrate skills of independent and teamwork, leadership qualities, to organise work under time constraints with an emphasis on professional integrity
PLO 8. To prepare reporting documentation on the results of solving complex professional (scientific and technical) problems, to present the research in the form of scientific reports, publications, conference reports, etc.
PLO 10. Calculate the economic efficiency of the production of elements and systems of aviation rocket and space technology.
PLO 12. To apply the requirements of industry and international regulations in the formulation and solution of scientific and technical problems of design, production, repair, assembly, testing and (or) certification of elements and objects of aviation and rocket and space technology at all stages of its life cycle.
PLO 14. Organise the implementation of complex tasks in professional activities by the team.
PLO 15. Apply modern methods and tools for design and systems of modern aviation and rocket and space technology.
PLO 17. Use in practice modern methods and means of design, production, testing, repair and (or) certification of aviation and rocket and space technology systems.
PLO 19. Develop and teach academic disciplines in higher education.

Additional skills:

- perform statistical analysis of aircraft prototype parameters based on data from printed, electronic and other sources of information;
- identify solved and formulate unsolved problems on the problem or task under study;
- formulate the purpose of the study and the tasks to be solved to achieve it;
- build a regression model of the experiment;
- evaluate the theoretical values of the main characteristics of a random process;
- search for scientific and technical information, including the use of modern information technologies;
- perform statistical analysis of the results of experimental studies for the normal distribution and Student's distribution, evaluate random errors;
- analyse the impact on the results of the experiment of large-scale effects, inconsistencies in environmental conditions, the impact of laboratory equipment, etc. and make appropriate adjustments to the results of the experiment based on existing methods;
- improve existing and develop new methods for introducing corrections to the results of experiments;
- apply statistical methods to determine the adequacy of physical models;
- perform approximation of discrete functions based on statistical analysis.
- performing an analytical review of available sources of information on the problem;
- systematisation of solving tasks on the problem;
- justification of the purpose of research or development;
- formulation of tasks, the solution of which leads to the achievement of the development goal.

1.Prerequisites and post-requisites of the discipline (place in the structural and logical scheme of study for the relevant educational programme)

The study of this discipline requires students to have the skills of using personal computers at the level of an experienced user, as well as the knowledge and skills they acquire when studying the disciplines of the first (bachelor's) level of training in the speciality "134 Aviation and Rocket and Space Engineering".

Successful study of the discipline prepares students for a master's thesis.

1. Content of the discipline

Chapter and topic titles	Number of hours				
	Total	including			
		Lectures	Practice works	Laboratory`s works	IWS
Chapter 1. Science.					
Topic1. Science and scientific research	60	9	18	-	33
Total hours:	**60**	9	18	-	33

2. Training materials and resources

Literatures:

2.1. Basic.

1. 1 Bilukha M.T. Osnovy naukovykh doslidzhen. – K.: Vyshcha shkola., 1997. – 271 p.
1.2 Hrishchuk Yu.S. Osnovy naukovykh doslidzhen.-Kh.:KhTI.,2008.-232p.
1.3 Tsekhmistrova H.S. Osnovy naukovykh doslidzhen.-K.: «Slovo», 2004,- 236p.
1.4 Kuzminska N.L. Statyska. –K.:KPI,2018.,-162p.
1.5 Sushchiuk - Sliusarenko V.I., Hadiniak R.A. Matematychna statystyka.-K.:KPI,2019.,60p.
1.6 Bidiuk P.I., Danylov B.Ya., Zhyrov O.L. Prykladna statystyka.-K.:KPI,2023,186p..

Supporting

2.1 H.H.Strelkova, M.M. Fedosenko, A.I.Zamulko. O.S.Ishchenko. Osnovy naukovykh doslidzhen. Kyiv: KPI im. Ihoria Sikorskoho, 2019. -120 p.
2.2 V. S. Rostovskyi, N. V. Dibrivska. Osnovy naukovykh doslidzhen i tekhnichnoi tvorchosti. –Kyiv: «TsUL»,2009.-96p.
2.3 Kalambet S.V. Metodolohiia naukovykh doslidzhen,konspekt lektsii.-Dn-k-2015,96p.
2.4 V.S. Hryhorkiv, O.Yu. Vinnychuk, M.V. Hryhorkiv, L.L. Makhanets. Statystyka: osnovy teorii ta praktykum.-Chernivtsi-2022, 302p.
2.5 Shapochka M.K., Matsenko O.M. Teoriia Statystyky. – Sumy-2014.,312p.

Online resources:

- http://kpi.ua.
- http:\\iat.kpi.ua.
- http:\\arb.kpi.ua.

Educational content

5. Methods of mastering the discipline (educational component)

Lecture classes.

Таблиця 2

№ з/п	**Title of the lecture topic and a list of key questions**
	Topic 1: Science and scientific research
1	**Lecture 1: Scientific and technical information**. The place of science in the knowledge system. Scientific research, its features and classification. Objectives and goals of scientific research. Scientific and technical information. Information search. Analysis of information and setting research objectives. IWS task: research of scientific and technical information on the topic of a master's thesis. Literature: [1.1]
2	**Lecture 2. Formulation of the topic, goals and objectives of the study.**
	Stages of choosing a research topic. Criteria for assessing the prospects of the chosen topic. Information analysis of the problem. Relevance, scientific and practical significance of the chosen topic. IWS task: formation of relevance, scientific and practical significance of the chosen topic of the master's thesis. Literature: [1.1]
3	**Lecture 3. Research methods** Methodology of theoretical research. Research models. Analytical research methods. Probabilistic and statistical methods of research. Methods of system analysis. Processing of research results. IWS task:: application of research methods to the topic of a master's thesis. Literature: [1 .1]
4	**Lecture 4. Analysis and design of scientific research. Implementation and effectiveness of scientific research.** Analysing theoretical and experimental studies and formulating conclusions and proposals. Preparation of reports on research work. Preparation of scientific materials for publication. Implementation of completed research work in production. Efficiency of scientific research and its criteria. Calculation of the economic efficiency of scientific research. IWS task:: Preparation for the publication of master's thesis materials. Literature: [1 .2]
5	**Lecture 5. Preparation of scientific publications on the topic of the master's thesis.** Types of scientific publications: abstracts and conference reports, scientific article. The structure of the presentation of material in scientific publications, the relevance of the conclusions of the work to the goal. IWS task:: Preparation publication of master's thesis materials. Literature: [1 .2]

Pracrice classes.

The main goal of the practical classes is an in-depth study of scientific research methods.

№ p/c	Name of practice classes	Number of hrs
1	Searching for scientific information, systematising it, writing it up in the form of a report with references to the sources used,[2.1,2.3].	4
2	Basic characteristics and experimental analysis of of multivariate random variables, [2.1,2.3].	2
3	Elementary statistical procedures,[2.1,2.3].	4
4	Coverage of the current state of scientific research on the topic of the master's thesis.	2
5	Full factorial experiment,[2.1,2.3].	4
6	Analytical research of sources on the topic of the master's thesis, [2.1,2.3].	4

Laboratory classes.

The credit module "Research work on the topic of master's thesis -1" does not include laboratory work.

Independent work of students

The student's independent work consists of preparing for classroom lessons and reading the relevant literature. The scope and topics of students' independent work are set out in Table 2.

Policy and control

5. Policy of academic discipline (educational component)

Grading policy (missed classes, making up for absences): each grade is assigned in accordance with the criteria developed by teacher and announced to students in advance, as well as motivated individually at the student request; if student does not complete all prescribed classes, he will not be admitted to credit; missed classes must be made up. The form and time of practice are mutually agreed upon by student and teacher.

Academic integrity

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

Norms of ethical behavior

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

6. **Types of control and rating system for assessing learning outcomes (RSO)**

At the first lesson, students are introduced to the rating system of assessment of the

discipline, which is based on the Regulations on the system of assessment of learning outcomes https://document.kpi.ua/files/2020_1-273.pdf

Current control is carried out at each practical lesson in accordance with the specific objectives of the topic in order to check the degree and quality of learning. At all classes, objective control of theoretical training and mastery of practical skills is applied to check the readiness of the higher education student for the class. In the process of current control, the student's independent work is assessed in terms of completeness of tasks, level of learning, mastery of practical skills of analytical and research work, etc. The results of the current control are entered into the Igor Sikorsky Kyiv Polytechnic Institute Campus System*.*

Calendar control: is carried out twice a semester as a monitoring of the current state of fulfilment of the requirements of the silaBUS. To receive a "pass" in the first interim assessment (week 8), a student must have at least 15 points (provided that at the beginning of week 8, according to the calendar control plan, an "ideal" student must receive 24 points). To receive "passed" in the second interim assessment (14th week), a student must have at least
week), a student will have at least 28 points (provided that at the beginning of week 14, according to the calendar plan of control measures, an "ideal" student should receive 42 points).

The student's rating in the discipline consists of the points he or she receives for the following:

1. practical classes;

2. tests.

1. Practical work
Weight score – 5.
The maximum number of points is equal to 6 points x8 = 48 points.
Evaluation criteria:
- full completion of the task - 5;
- implementation, but theoretical knowledge is insufficient - 3...4;
- not prepared - 0.

2. Calculation and graphic work
Weight score – 8.
The maximum number of points is equal to 8 points x1 = 8 points.
Evaluation criteria:
• complete completion of the task - 8;
• implementation, but theoretical knowledge is insufficient — 5 ... 6;
• execution, but no report - 3;
• work was not performed - 0.

3. Modular control work
Weight score – 47.
The maximum number of points is equal to 47 points x 1 = 47 points.
Evaluation criteria:
• complete completion of the task - 47;
• incomplete completion of the task - 25...40;
• work was not performed - 0.
Penalty and incentive points:
• creative approach to work, active participation in discussion of topics, independent
search for topics: +1...3 points;
• absence of missing lectures without valid reasons: +1...3 points;

• absence from class without a valid reason: –1...–5 points.

The maximum number of incentive points is 5.

Calculation of the rating scale (R):

Thus, the rating scale for the discipline is:

R = 48 + 8 + 44 = 100 points.

Table of correspondence of rating points to grades on the university scale:

Scores Rating

100-95 Excellent

94-85 Very good

84-75 Good

74-65 Satisfactory

64-60 Enough

Less than 60 Unsatisfactory

Admission conditions are not met Not allowed

9. Additional information on the discipline (educational component)

If a graduate student is transferred from another university is recalculated only if the curriculum is consistent.

Work program of the discipline (syllabus):

Compiled by Associate Professor of the Department of Aircraft and Rocket Engineering, PhD , Lukianov P.V.

Approved by the Department of Aircraft and Rocket Engineering (Minutes № 10 of 16.06.2023)

Approvedby the Methodological Commission of the IAT (Minutes № 6 of 22 .06.2023)