




Scientific Principles of Aerospace and Rocket-Space Manufacturing Technologies

Programme Subject Area: *G12 Aerospace Engineering*

Level of Higher Education	<i>Third (PhD)</i>
Course Status	<i>Elective course, Semester 2</i>
Scope of discipline	150 hours / 5 ECTS credits
Language	<i>Ukrainian / English</i>
What will be studied (subject of study)	<p>The course is aimed at developing PhD students' comprehensive understanding of contemporary scientific approaches to manufacturing and repair technologies for aerospace systems throughout the entire product life cycle.</p> <p>The course covers the following topics:</p> <ul style="list-style-type: none"> - Current state and future trends in manufacturing technologies for aerospace and rocket-and-space engineering products; - Scientific principles of production engineering and manufacturing process planning in the aerospace industry; - Design for manufacturability of aerospace structures; - Theoretical foundations of the formation and assurance of accuracy in assembly processes; - Modern methods of aircraft structure assembly; - Impulse technologies in aircraft assembly and installation processes; - Computer-integrated technologies in modern aerospace manufacturing; - Application of CAD/CAM/CAE/CAPP/PLM systems in production engineering and manufacturing process planning; - Robotics and automation of manufacturing and assembly processes at aerospace enterprises; - Numerical simulation of forming, strengthening, and assembly processes for aerospace structures; - Reverse engineering technologies for ensuring the geometric accuracy of aerospace products; - Re-engineering of manufacturing processes and reduction of production engineering lead times; - Additive manufacturing technologies and 3D printing in the production of aerospace and rocket-and-space engineering products; - 3D scanning and reverse engineering technologies; - Ontology-based decision support systems for selecting aerospace structure assembly technologies; - Planning and conducting experimental investigations of manufacturing processes; - Investigation of welding, sheet metal forming, machining, riveting, and assembly processes; - Statistical methods for processing and analyzing experimental data.
Why is it interesting/should be studied (goal)	<p>The course goals to equip PhD students with advanced scientific knowledge and practical competencies in the development, investigation, and optimization of modern manufacturing and assembly technologies for aerospace and rocket-and-space engineering products based on the application of digital technologies, impulse processing, robotics and automation, additive manufacturing, and reverse engineering methodologies.</p>

Why is it interesting/should be studied (goal)	Objectives (tasks): To develop PhD students' competencies in designing, investigating, and optimizing advanced manufacturing and assembly processes for aerospace and rocket-and-space engineering products through the application of state-of-the-art manufacturing technologies.											
How can you use the acquired knowledge and skills (competencies)	<p>Upon successful completion of the course, PhD students will acquire the following general and professional competencies and achieve the corresponding learning outcomes.</p> <p style="text-align: center;">General Competencies</p> <p>Ability to identify, formulate, and solve problems. Ability to search, process, and analyze information from various sources. Ability to solve complex problems in the field of aerospace engineering based on a systematic scientific worldview and broad cultural awareness, while adhering to the principles of professional ethics and academic integrity.</p> <p style="text-align: center;">Professional Competencies</p> <p>Ability to conduct original research and obtain scientific results that generate new knowledge in aerospace engineering and related interdisciplinary fields. Ability to initiate, develop, and implement complex innovative projects in aerospace engineering and related interdisciplinary areas. Ability to apply modern information technologies, specialized software, and advanced automated equipment in planning, conducting, and processing experimental investigations.</p> <p style="text-align: center;">Learning Outcomes</p> <p>Formulate and test hypotheses, and use appropriate evidence to substantiate conclusions, including the results of theoretical analyses, experimental investigations, mathematical and/or computer modeling, and available literature data. Develop and investigate conceptual, mathematical, and computer models of processes and systems, and effectively use them to generate new knowledge and/or create innovative products in aerospace engineering and related interdisciplinary fields. Plan and conduct experimental and/or theoretical studies on the development of advanced aerospace products and related interdisciplinary areas using modern tools; critically analyze the results of their own research and those of other researchers in the context of current knowledge related to the investigated problem. Apply modern tools and technologies for information retrieval, processing, and analysis, including statistical methods for analyzing large and/or complex datasets, specialized databases, and information systems. Understand the general principles and methods of engineering and natural sciences, as well as research methodology, and apply them in their own studies in aerospace engineering, related interdisciplinary fields, and teaching practice.</p>											
Prerequisites	Theoretical Basics of Aircraft Manufacturing Technologies, Aircraft and Helicopter Manufacturing Technology, Computer-Aided Design of Technological Tooling, Assembly and Installation Technology, Fundamentals of Additive Manufacturing, Design of Engineering Experiments											
Organization of training	Types of classes: lectures, practical, self-study. Forms of education: full-time / part-time Forms of control: exam											
Department	Aircraft Manufacturing Engineering (#104)											
Faculty	Aircraft Engineering											
Teachers		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; text-align: center;">Name</td> <td style="text-align: center;">Kateryna Maiorova</td> </tr> <tr> <td style="text-align: center;">Position</td> <td style="text-align: center;">Head of the Department</td> </tr> <tr> <td style="text-align: center;">Academic title</td> <td style="text-align: center;">Associate Professor</td> </tr> <tr> <td style="text-align: center;">Scientific degree</td> <td style="text-align: center;">PhD</td> </tr> <tr> <td style="text-align: center;">e-mail</td> <td style="text-align: center;">k.majorova@khai.edu</td> </tr> </table>	Name	Kateryna Maiorova	Position	Head of the Department	Academic title	Associate Professor	Scientific degree	PhD	e-mail	k.majorova@khai.edu
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Links to course materials

Maiorova Kateryna:

<https://www.scopus.com/authid/detail.uri?authorId=57204427689>

Vorobiov Iurii:

<https://www.scopus.com/authid/detail.uri?authorId=57205383504>

"Mentor" Distance Learning System:

<https://mentor.khai.edu/course/view.php?id=10257>