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

Machines and devices of chemical and oil refining industries

Computerized 3D printing technologies

Working program of the academic discipline (Syllabus)

Details of the academic discipline

Level of higher education	*First (undergraduate)*
Branch of knowledge	*13 Mechanical engineering*
Specialty	*133 Industrial engineering*
Educational program	*Computer-integrated equipment design technologies chemical engineering*
Discipline status	*Selective*
Form of education	*full-time (face-to-face/distance)*
Year of training, semester	*3rd year, spring semester*
Scope of the discipline	*4 credits, 120 hours, of which 54 hours – classroom classes (18 hours – lectures; 36 hours – practical); 66 hours – SRS, including 18 hours – control measures (6 hours – MKR; 6 hours – GR; 6 hours – tests) Credit*
Terminal control/ controls activities	
Lessons schedule	*https://rozklad.kpi.ua/ https://ecampus.kpi.ua/*
Language of teaching	*Ukrainian*
Information about course leader / teachers	*Lecturer: Ph.D., docent Heyday Serhii Serhiyovych ssgaidai@gmail.com* *practical: Ph.D., associate professor Heyday Serhii Serhiyovych ssgaidai@gmail.com*
Placement of the course	*https://ecampus.kpi.ua/*

Program of educational discipline

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

The term Additive manufacturing has become widespread throughout the world - this term can most accurately be translated as additive manufacturing or layer-by-layer process production. 3D printing (or 3D prototyping) is made with the following main stages: creation of a three-dimensional model of the object that is planned to be manufactured; Slicing this model into many layers; directly printing a 3D model on a 3D printer layer by layer.

Parts manufactured by 3D printing can have a complex geometric shape, while the complexity of the part affects the speed and quality when it is manufactured using 3D printing technologies.

3D printing technologies allow the use of a large number of different materials for printing - polymers, metals, ceramics, biomaterials, food products and even paper.

In practice, during training in this discipline, designed 3D models of industrial equipment and its parts will be produced using 3D printing using polymer composites as material.

Studying this discipline will allow students to master the fundamental concepts of 3D printing theories. It will allow you to formulate an idea about the methods and basic principles of 3D printing. It will contribute to the understanding of the dependence of the effectiveness of 3D printing on the realization of obtaining a high-quality result in the form of a ready-made 3D model of industrial equipment and its details. Formulation of ideas and mastering of prototyping techniques when applying 3D printing technologies of equipment (industrial and its parts) for various tasks will allow to create a professional basic basis for further successful development of energy-efficient industrial equipment and minimize its metal consumption.

The subject of the academic discipline

A systematic approach to studying the processes of 3D modeling and 3D printing of developed models of industrial equipment and its details with different geometric configurations. Designing 3D models industrial equipment and its details considering features of 3D printing and determination of the most optimal conditions for carrying out the 3D printing process.

Interdisciplinary connections

The discipline "Computerized 3D printing technologies" is based on the following disciplines: "Processes and devices of chemical technology. Part 1. Thermal processes"; "Physics. Part 1. Classical physics"; "Industrial ecology"; "General and inorganic chemistry. Part 1. General chemistry"; "General and inorganic chemistry. Part 2. Inorganic chemistry"; "Higher mathematics. Part 1. Linear algebra and analytic geometry. Differential calculus"; "Higher mathematics. Part 2. Integral calculus and differential equations".

The purpose of this educational discipline *is the formation of thorough skills of use methods and techniques necessary to achieve the realism of designed 3D models equipment with 3D printing (prototyping).*

The main tasks of the academic discipline

teach students 3D printing technology (prototyping);

gain practical skills in designing and 3D printing (prototyping); learn to understand the structure of materials and choose optimal conditions for 3D printing;

get practical skills in 3D printing technology;

learn the principles of designing 3D models based on the acquired knowledge;

use modeling methods in prototyping for 3D printing of new 3D-models;

- carry out 3D printing using methods and means to achieve the necessary technological requirements for 3D equipment models.

In accordance with the goal, the training of bachelors requires deepening of the competences formed by students:

- the ability to use the provisions and methods of fundamental sciences to solve professional problems;

- the ability to design industrial equipment and its details taking into account technical, legislative and environmental restrictions;

- the ability to use modern materials, technologies and apparatus designs in chemical engineering;

- the ability to choose and use appropriate equipment, tools and methods for control and management of technological processes of chemical production;

- the ability to use computing and information technologies to solve complex problems and practical problems in the field of chemical engineering;

- the ability to take into account the commercial and economic context when designing chemical productions;

- the ability to apply modern experimental methods of working with technological objects in industrial and laboratory conditions;

- ability to abstract thinking, analysis and synthesis;

- ability to apply knowledge in practical situations;

- knowledge and understanding of the subject area and understanding of professional activity; the ability to communicate in the state language both orally and in writing;

- the desire to preserve the environment.

Program results of the academic discipline

- Be able to experiment and analyze data;

- Know and be able to use the knowledge of fundamental sciences underlying 3D printing technology (equipment prototyping) at the level necessary to achieve other results of the educational program;

- Qualified selection of materials for products of various purposes;

- Know and apply 3D printing technologies (prototyping) in professional activities equipment);

- Know mathematics, physics and chemistry at the level necessary to achieve the results of the educational program;

- Correctly use the terminology and basic concepts of chemistry, chemical technologies, processes and equipment for the production of chemical substances and materials based on them in professional activities;

- To know and understand the mechanisms and kinetics of processes, to use them effectively in the design and improvement of technological processes and apparatus of the chemical industry;

- Develop and implement projects related to technologies and equipment of chemical industries, taking into account goals, resources, existing limitations, social and economic aspects and risks;

- Understand the main properties of structural materials, principles and limitations of their use in chemical engineering;

- Choose and use appropriate equipment, tools and methods for solving complex problems of chemical engineering, control and management of technological processes of chemical production;

- Use modern computer equipment, specialized software and information technologies to solve complex problems and practical problems in the field of chemical engineering;

- Ensure the safety of personnel and the environment during professional activity in the field of chemical engineering;

- Discuss the results of professional activity with specialists and non-specialists, argue one's own position;

- Communicate freely on professional issues orally and in writing in the state language;

- Understanding chemical engineering as a component of modern science and technology, its place in development engineering, the Ukrainian state and world culture.

2. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to corresponding educational program)

Prerequisites: *the ability to apply knowledge in practice when evaluating methods calculation of hydromechanical and mass transfer processes, skills in using information and computer technologies for designing and prototyping industrial equipment and*