Код та назва дисципліни українською мовою/ Назва дисципліни англійською мовою	**Зу-10-32** Теорія оптимального керування / The theory of optimal control
Рекомендується для галузі знань	For all specialties (discipline of university choice)
Кафедра	Cybersecurity and computer-integrated technologies
П.І.П. НПП (*за можливості*)	Petrenko O.M., Klymenko S.V.
Рівень ВО	Third (Education and Science)
КУРС, семестр (*в якому буде викладатись*)	1-2 course
Мова викладання	English language
Пререквізити (передумови вивчення дисципліни)	Basic knowledge of higher mathematics; skills in mathematical modelling of technical systems; knowledge of classical control theory; Experience with mathematical software tools
Чому це цікаво/треба вивчати	The Theory of Optimal Control plays a key role in modern engineering, economics, robotics, aerospace, and artificial intelligence. It provides powerful mathematical tools for making the best possible decisions in dynamic systems under constraints.
Перелік тем з дисципліни	1. Introduction to Optimal Control Theory. Basic concepts and applications. The structure of control systems. Mathematical Models of Dynamic Systems. Differential equations in control. Linear and nonlinear systems. The Optimal Control Problem. Performance criteria. Control constraints. Problem formulation. 3. Pontryagin's Maximum Principle. Necessary conditions for optimality. The Hamiltonian function. 4. The Calculus of Variations. Functional optimisation. Euler–Lagrange equations. 5. Dynamic Programming. Bellman's principle of optimality. The Hamilton–Jacobi–Bellman (HJB) equation. 6. Linear Quadratic Regulator (LQR). Optimisation for Linear Systems with Quadratic Costs. 7. Bang-Bang and Singular Controls. Time-optimal and energy-optimal solutions. 8. Numerical Methods in Optimal Control. Discretisation, shooting method, direct and indirect methods. 9. Applications of Optimal Control. Engineering systems, robotics, economics, and aerospace.
Як можна користуватися набутими знаннями і уміннями (*компетентність*)	1. Ability to model and analyze dynamic systems using mathematical tools and formulate control tasks based on system behavior and constraints. 2. Ability to apply optimal control methods, including Pontryagin's Maximum Principle and dynamic programming, to solve practical engineering problems. 3. Ability to use modern computational tools to implement and simulate optimal control strategies in real-world scenarios.
Очікувані результати навчання	1. Ability to formulate optimal control problems for linear and nonlinear systems with given performance criteria and constraints. 2. Ability to apply analytical and numerical methods such as the calculus of variations, Pontryagin's Maximum Principle, and Bellman's Principle to solve control tasks. 3. Ability to design and implement optimal control strategies using simulation software (e.g., MATLAB/Simulink) for practical engineering systems.
Інформаційне забезпечення	lecture notes, methodological instructions for practical classes
Види навчальних занять	lectures and practical activities
Вид семестрового контролю	differentiated credit
Максимальна кількість здобувачів на семестр/ Мінімальна кількість здобувачів (*тільки для мовних, творчих дисциплін, за необхідності*)	No restrictions