МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ХАРКІВСЬКИЙ НАЦІОНАЛЬНИЙ ЕКОНОМІЧНИЙ УНІВЕРСИТЕТ
ІМЕНІ СЕМЕНА КУЗНЕЦЯ

ЗАТВЕРДЖЕНО
на засіданні кафедри
кібербезпеки та
інформаційних технологій
Протокол № 2 від 29.08.2024 р
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ПОГОДЖЕНО
Проректор з навчально-методичної роботи
_____ Карина НЕМАШКАЛО

КОМП'ЮТЕРНЕ МОДЕЛЮВАННЯ ТА ОПТИМІЗАЦІЯ БІЗНЕС-ПРОЦЕСІВ

робоча програма навчальної дисципліни (РПНД)

Галузь знань	**12 "Інформаційні технології"**
Спеціальність	**122 "Комп'ютерні науки"**
Освітній рівень	**другий (магістерський)**
Освітня програма	**"Комп'ютерні науки"**

Статус дисципліни	**вибіркова**
Мова викладання, навчання та оцінювання	**англійська**

Розробник(и): науковий ступінь, вчене звання	підписано КЕП	Ганна СОЛОДОВНИК
Завідувач кафедри кібербезпеки та інформаційних технологій	підписано КЕП	Ольга СТАРКОВА
Гарант програми	підписано КЕП	Сергій МІНУХІН

Харків
2024

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

APPROVED
at the session of
the Department of Cybersecurity and
Information Technologies
Protocol № 2 29.08.2024.

AGREED
Vice-Rector for Educational and
Methodical Work

Karina NEMASHKALO

COMPUTER MODELING AND OPTIMIZATION OF BUSINESS PROCESSES

Program of the course

Field of knowledge	**12 "Information technologies"**
Speciality	**122 "Computer sciences"**
Study cycle	**second (master's)**
Study programme	**"Computer sciences"**
Course status	**elective**
Language	**english**

Developer(s): academic degree, academic rank	Digitally signed	Ganna SOLODOVNYK
Head of Department cybersecurity and Information Technology	Digitally signed	Olga STARKOVA
Head of Study Programme	Digitally signed	Serhii MINUKHIN

Kharkiv
2024

INTRODUCTION

The relevance of teaching the course "Computer Modeling and Optimization of Business Processes" is driven by the competition and dynamism of market conditions that require companies to make quick and well-founded decisions. Computer modeling allows for the analysis of existing processes, identification of bottlenecks, and testing of various optimization scenarios without the need to interfere with real operations. This provides companies with flexibility and reduces risks associated with the implementation of new strategies, making the discipline extremely important for future specialists in management, economics, and information technology.

Teaching this course fosters the development of critical thinking and problem-solving skills, which are key competencies for a successful career in today's conditions. The ability to model business processes enables students to develop effective strategies and improve operational processes, which directly affects cost reduction, improved customer service quality, and increased organizational profitability. Thus, the discipline "Computer Modeling and Optimization of Business Processes" not only meets labor market demands but also promotes the development of innovative thinking and a strategic approach to business management.

The course "Computer Modeling and Optimization of Business Processes" is intended for higher education students studying for the "Master" qualification level. The study of the discipline aims to equip future specialists with the skills and competencies for effective use of modern tools and software widely used in modeling and optimizing business processes. This knowledge enables future specialists to analyze large volumes of data, predict system behavior, and make decisions based on objective, quantitative data.

The goal of the course "Computer Modeling and Optimization of Business Processes" is to form a system of theoretical knowledge and acquire practical skills in computer modeling of business processes; building models to describe the subject area; analyzing business processes and optimizing them to improve certain aspects of the activities of enterprises and organizations.

The task of the course is to develop students' competencies in the analysis of the subject area of design (processes, systems, and control objects), building models of complex systems and control objects using various tools; developing competencies in analyzing built models, identifying problematic areas, and optimizing business processes based on this data.

The subject of the course is the fundamentals of computer modeling and information technologies related to the analysis and optimization of business processes in enterprises.

The object of the course is objects, systems, and processes for which modeling and management information technologies are implemented.

The learning outcomes and competencies formed by the course are defined in table 1.

Table 1

Learning outcomes and competencies formed by the course

Learning outcomes	**Competencies that a higher education applicant should master**
LO 1	GC 01, GC 05, SC 01
LO 7	GC 07, SC 03
LO 8	GC 06, SC 04
LO 18	GC 05, SC 02

where, LO 1. Have specialized conceptual knowledge that includes modern scientific achievements in the field of computer science and is the basis for original thinking and conducting research, critical understanding of problems in the field of computer science and at the border of fields of knowledge.

LO7. Develop and apply mathematical methods for the analysis of information models.

LO 8. Develop mathematical models and data analysis methods (including large ones).

LO 18. Collect, formalize, systematize and analyze the needs and requirements for the information or computer system being developed, operated or supported.

GC01. Ability to abstract thinking, analysis and synthesis.

GC05. Ability to learn and master modern knowledge.

GC06. Ability to be critical and self-critical.

GC07. Ability to generate new ideas (creativity).

SC01. Awareness of the theoretical foundations of computer science.

SC02. The ability to formalize the subject area of a certain project in the form of an appropriate information model.

SC03. Ability to use mathematical methods to analyze formalized models of the subject area.

SC04. The ability to collect and analyze data (including large data) to ensure the quality of project decision-making.

COURSE CONTENT

Content Module 1: Modern Business Processes and General Principles of Their Organization

Topic 1: Theoretical Foundations of the Business Process Modeling

Introduction to the discipline. The essence of the process approach. Business process automation. International standard for building a quality management system of an organization.

Topic 2: Methodologies for Business Process Modeling

Methodologies for describing high-level processes. Methodologies for describing low-level processes. Using IDEF0 standard diagrams to describe business processes. Modeling data flows for the selected subject area. Describing the logic of interaction between components of objects and processes of the information system. Object-oriented approach methodologies for process description.

Content Module 2: Business Process Modeling and Optimization in BPMN Methodology

Topic 3: General Principles of Business Process Modeling in BPMN Methodology

General issues of using the BPMN standard. The main elements of a business process model in the BPMN standard. Basic rules of BPMN notation.

Topic 4: Technology of Using BPMN Methodology Elements for Business Process Modeling

Simulation in BizAgi. The main stages of conducting a simulation. Detailed description of simulation levels with screen forms of BizAgi.

Topic 5: Simulation Modeling of Business Processes

The essence, objects, and areas of application of simulation modeling. Technological features of simulation modeling. Main stages of simulation modeling.

The list of laboratory studies in the course is given in table 2.

Table 2

The list of laboratory studies

Name topics and / or task	Content
Topic 1. Laboratory work 1	Use of IDEF0 standard diagrams for describing business processes
Topic 2. Laboratory work 2	Description of the interaction logic of object components and processes of the subject area using the IDEF3 standard
Topic 3. Laboratory work 3	Building a visual model of a business process in BPMN notation
Topic 4. Laboratory work 4	Business process modeling, analysis, and optimization
Topic 5. Laboratory work 5	Simulation modeling of business processes

The list of self-studies in the course is given in table 3.

Table 3

List of self-studies

Name topics and / or task	Content
Topic 1. Task 1	Description of the main stages of business process modeling. Research of key concepts related to business process modeling. Defining the main goals and objectives of business process modeling in organizations. Analysis of the impact of business process modeling on the company's operational efficiency.
Topic 2. Task 2	Comparative analysis of various business process modeling methodologies (e.g., IDEF, ARIS, Lean, Six Sigma). Key characteristics, advantages, and disadvantages. Examples of practical application in organizations.
Topic 3. Task 3	Principles of business process modeling using the BPMN methodology. Analysis of key BPMN elements. Creating a business process model using BPMN notation. Research into how BPMN contributes to standardization and improves communication within the framework of business process modeling.
Topic 4. Task 4	A detailed business process model for a selected process using BPMN. Using different types of events, tasks, and gateways. Analysis of common errors that may arise during business process modeling using BPMN and how to avoid them.
Topic 5. Task 5	The main differences between simulation modeling and static modeling. Analysis of simulation modeling results: defining key performance indicators of the process and possible optimization paths based on the obtained data.

Number hours lectures, laboratory studies and hours of self-study is given in the technological card of the course.

TEACHING METHODS

During course teaching process for acquisition defined the application of learning results, activation of the educational process it is provided such methods as

Verbal (lecture (Topic 1–5).

Visual (demonstration (Topic 1–5)).

Practical (laboratory work (Topic 1–5)).

FORMS AND METHODS OF ASSESSMENT

The University uses a 100-point cumulative system for assessing the learning outcomes of students.

Current control is carried out during lectures, laboratory and classes and is aimed at checking the level of readiness of the student to perform a specific job and is evaluated by the amount of points scored: for courses with a form of semester control as an exam: maximum amount is 60 points; minimum amount required is 35 points.

The final control includes current control and an exam.

Semester control is carried out in the form of a semester exam.

The final grade in the course is determined: for disciplines with a form of exam, the final grade is the amount of all points received during the current control and the exam grade.

During the teaching of the course, the following control measures are used:

Current control: laboratory work (50 points), tests (10 points).

Semester control: grading including Exam (40 points).

More detailed information on the assessment system is provided in technological card of the course.

An example of an exam card and assessment criteria.

An example of an examination ticket.

Simon Kuznets Kharkiv National University of Economics
Second (master's) level of higher education
Specialty 122 "Computer sciences"
Educational and professional program "Computer sciences"
Educational discipline "Computer Modeling and Optimization of Business Processes"

EXAMINATION TICKET No. 1

Task 1 (stereotypical). (10 points)

Trere are 20 closed-form test tasks. The correct answer is one.

Task 2 (heuristic). (30 points)

1. Build a model based on your subject area (the number of the subject area corresponds to the number of your ticket).
2. Run a simulation of your model under several scenarios.
3. Using What-If analysis, compare the scenarios, analyze the results, and formulate conclusions.

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Examiner Ganna SOLODOVNYK

Head of Department Olha STARKOVA

Assessment criteria

The final exam consists of answering test questions provided in the exam ticket and creating a report on the completion of the task. A condition for admission to the exam is a positive final score for the study of the discipline (more than 35 points). The exam ticket consists of two tasks. The final exam grade is the sum of the grades for each task. The first task is graded from 0 to 10 points, depending on the number of correct answers to the test questions. The second task is graded from 0 to 30 points (in

total) based on the following components: 15 points – a correctly and fully constructed model for the subject area according to the requirements of BPMN 2.0 notation; 10 points – a correctly and fully conducted simulation of the model under several scenarios; 5 points – a correctly conducted What-If analysis, analyzed results, and fully formulated conclusions. If the parts of the task described above are not fully completed, 1 point will be deducted from the maximum score for each incomplete part.

RECOMMENDED LITERATURE

Main

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