ЗАТВЕРДЖЕНО
на засіданні кафедри
інформаційних систем
Протокол № 1 від 27.08.2024 р.

ПОГОДЖЕНО
Проректор з навчально-методичної роботи

_____ Каріна НЕМАШКАЛО

АНАЛІЗ ТА ОПТИМІЗАЦІЯ БІЗНЕС-ПРОЦЕСІВ ПІДПРИЄМСТВ

робоча програма навчальної дисципліни (РПНД)

Галузь знань	**12 "Інформаційні технології"**
Спеціальність	**126 "Інформаційні системи та технології"**
Освітній рівень	**другий (магістерський)**
Освітня програма	**"Інформаційні системи та технології"**

Статус дисципліни	**обов'язкова**
Мова викладання, навчання та оцінювання	**англійська**

Розробник:
к.е.н., доцент   підписано КЕП   Олексій БЕСЕДОВСЬКИЙ

Завідувач кафедри
інформаційних систем   _____   Дмитро БОНДАРЕНКО

Гарант програми   підписано КЕП   Олександр КОЛГАТІН

Харків
2024

APPROVED	**AGREED**
at the meeting of the Information Systems Department	Vice-rector for educational and methodical work
Protocol № 1 of 27.08.2024	_____ Karina NEMASHKALO

Analysis and Optimization of Enterprises Business Processes
Program of the course

Field of knowledge	**12 "Information technologies"**
Specialty	**126 " Information systems and technologies"**
Study cycle	**second (master)**
Study programme	**"Information systems and technologies"**

Course status	**mandatory**
Language	**English**

Developers:

PhD, Associate Professor   _digital signature_   Oleksii BESEDOVSKYI

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Kharkiv
2024

INTRODUCTION

Information in the modern world has become one of the most important resources, and information systems (IS) have become an essential tool in almost all areas of activity. The diversity of tasks solved with the help of IS has led to the emergence of many different types of systems that differ in their design principles and information processing rules.

At the same time, IS customers have started to put forward more and more requirements aimed at ensuring the possibility of integrated use of information in the management of enterprise activities. One of the most pressing issues is the management of business processes. However, performing these tasks manually is a laborious and time-consuming process. Therefore, more and more enterprises are beginning to pay more attention to the automation of their business processes, as well as their optimization.

The course "Analysis and Optimization of Enterprises' Business Processes" is mandatory and is studied for the training of masters in the specialty 126 "Information Systems and Technologies" of the second (master's) educational level.

The purpose of teaching the course "Analysis and Optimization of Enterprises' Business Processes" is to provide higher education students with the features of describing business processes using modern approaches and methodologies, analyzing these processes and finding ways to optimize them.

To this end, the course focuses on the use of the BPMN standard for analyzing, modeling and optimizing business processes. The course is based on the use of business games and modern software products that implement this methodology.

The objectives of the course are:

analysis of the essence, types, clients of business processes;

mastering the principles of construction, purpose of the BPMN standard, its main elements, etc;

mastering the basic approaches to analyzing the quality of business processes and their optimization;

mastering the skills of analyzing and optimizing business processes, as well as presenting the results of the business process research to the company's management.

The subject of the course is business processes of enterprises, the BPMN methodology used to describe and analyze them.

The object of the course is modern theoretical concepts and methodologies, principles of operation, analysis and optimization of business processes of enterprises.

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
LO01	IC, GC01, SC08
LO02	GC03
LO03	SC01, SC08
LO04	GC03, SC01, SC07
LO05	GC03, SC08
LO08	IK, GC01, SC04, SC05, SC08
LO09	SC04, SC05
LO11	GC01, GC03, SC01, SC04, SC05, SC07
LO12	IC, GC01, GC03, SC03, SC04, SC05, SC08

where, LO01. Searching for necessary information in scientific and technical literature, databases, other sources, analyse and evaluate this information.

LO02. Communicating freely in national and foreign languages in scientific, industrial and social spheres of activity.

LO03. Making effective decisions on the problems of information infrastructure development, creation and application of IT.

LO04. Managing ICT development, implementation and operation processes that are complex, unpredictable and require new strategic and team approaches.

LO05. Determining the requirements for ICT on base of business processes and needs of interested parties' analysis, to develop technical tasks.

LO08. Developing models of information processes and systems of various classes, to use methods of modelling, formalisation, algorithmization and implementation of models using modern computer tools.

LO09. Developing and use data warehouses, to perform data analysis for supporting decision-making.

LO11. Solving the problems of digital transformation in new or unknown environments based on specialised conceptual knowledge, including modern scientific achievements in the field of information technology, researches and integration of knowledge from various fields.

LO12. Improving the information system on the base of business processes analysis.

IC. The ability to solve problems of a research and innovation nature in the field of information systems and technologies.

GC01. Ability to abstract thinking, analysis and synthesis.

GC03. Ability to communicate with representatives of other professional groups at different levels (with experts from other fields of knowledge/types of economic activity).

SC01. Ability to develop and apply IST necessary for solving strategic and current tasks.

SC03. Ability to design information systems taking into account the specifics of their purpose, incomplete/insufficient information and conflicting requirements.

SC04. The ability to develop mathematical, information and computer models of objects and informatization processes.

SC05. Ability to use modern data analysis technologies to optimize processes in information systems.
SC07. Develop and implement innovative projects in the field of ICT.
SC08. Carry out reengineering of applied information systems and business processes.

COURSE CONTENT

Content module 1. Business processes of enterprises. General principles of their organization

Topic 1: Theoretical basis of the business process modeling
1.1. Process approach to management.
1.2. Model and modeling: theoretical foundations.
1.3. Methodologies for business process design.
Topic 2. Business process modeling using various technologies
2.1. Methodologies for describing top-level processes.
2.2. Methodologies for describing lower-level processes.
2.3. Methodologies of the object-oriented approach to process description.
2.4. Modern methodology for describing business processes - top-level processes.

Content module 2. Modeling and optimization of business processes in the BPMN methodology

Topic 3. General principles of business process modeling in the BPMN methodology.
3.1. General issues of using the BPMN standard.
3.2. The main elements of a business process model in the BPMN standard.
Topic 4. Technology for using elements of the BPMN methodology to model business processes.
4.1. Scenarios for describing business processes using actions.
4.2. Gateways as an essential component for describing business process scenarios.
4.3. Events for describing business processes.
4.4. Processes and subprocesses.
4.5. Areas of responsibility.
4.6. Artifacts.
Topic 5. Simulation of business processes.
5.1. The concept of business process simulation.
5.2. Types of business process simulation.
5.3. Organization of business process simulation.

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

Table 2

The list of laboratory studies

Name of the topic and/or task	Content
Topic 3. General principles of business process	Analysis and simulation of enterprise call

modeling in the BPMN methodology	center business processes
Topic 4. Technology for using elements of the BPMN methodology to model business processes	Business process modeling
Topic 5. Simulation of business processes	Simulation of business processes
Topic 5. Simulation of business processes	Presentation of the results of enterprise optimization using infographics

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

Table 3

List of self-studies

Name of the topic and/or task	Content
Topic 1-5	Study of lecture material
Topic 3-5	Preparation for laboratory classes
Topic 1-5	Preparation for the exam

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

TEACHING METHODS

In the process of teaching the course, in order to acquire certain learning outcomes, to activate the educational process, it is envisaged to use such teaching methods as:
Verbal (lecture (Topics 1 – 4), problem lecture (Topic 5).
Visual (demonstration (Topics 1 – 5)).
Laboratory work (Topics 3 – 5), business game (Topic 3), group task (Topics 1, 4).

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 and laboratory 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. Semester exams are taken during the examination session.
The maximum amount of points that a higher education student can receive during an exam is 40 points. The minimum amount for which an exam (examination) is considered passed is 25 points.
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: defense of laboratory work (maximum score – 24 points); group competency-based task (maximum score – 12 points); individual task (maximum score – 6 points); theoretical tests (maximum score – 8 points); practical control works (maximum score – 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.

Example of an exam ticket

Simon Kuznets Kharkiv National University of Economics
Second (master's) study cycle
Specialty "Information systems and technologies"
Study program "Information systems and technologies"
Semester I
Course " Analysis and optimization of enterprises' business processes "

EXAM TICKET № 1

Task 1 (25 points).
Develop a model of the business process "Order Fulfillment" in BPMN notation. It is necessary to build a business process from the point of view of the company that manufactures the product.
A verbal description of the business process to be modeled.
Note: regarding the performers: all work (except for those for which it is specified separately) is performed by the sales manager.
The process starts after receiving a purchase order.
Detailed information about the order is entered by the call center operator into the ERP system (15 minutes). After that, the call center operator checks the order for accuracy and completeness (5 minutes).
If the order details are incorrect (20% of cases), the call center operator generates a request to correct the order (8 minutes); after receiving the corrected order, this data must be updated (entered) into the ERP system and checked again. This is repeated until the order is correct and complete.
After that, it should check whether the ordered product is available in the warehouse (12 minutes). However, if the order is placed on a Friday evening or on a weekend, the availability check should be delayed until Monday, as the product availability information is updated every Sunday evening. The share of orders placed on Friday evening or on weekends is 15%.
If the product is in stock (0.7 probability), it will be received from the warehouse (35 minutes).
If the product is not available, the sales manager first orders the raw materials for it from the supplier (12 minutes), receives the raw materials from the supplier (26 minutes), and then the product must be manufactured by the shop floor (660 minutes). Depending on the ordered product, the raw materials must be ordered from supplier 1 (probability 0.4) or supplier 2 (probability 0.6). However, in some cases, production requires raw materials from both suppliers.
If a failure (error) occurs during the manufacturing process (2% of cases), the order must be canceled by the sales manager (9 minutes), and the received (and partially processed) raw materials must be disposed of by the workshop worker at the same time (54 minutes). In this case, the process should end unsuccessfully.
If the production is successful, the ordered product is packaged by the delivery manager (15 minutes) and sent to the customer (12 minutes).
At the same time, the invoice is sent to the customer (3 minutes). Based on this invoice, payment for the products is received from the customer.

After sending the products to the customer and receiving payment for them, the order should be closed and archived (2 minutes).

Assume that the work starts immediately after each other, unless otherwise specified in the terms and conditions. Exceptions - waiting for the product availability check in the warehouse if the order is received on Friday evening or on weekends.

The cost of each email sent is 5 hryvnias.

The hourly wage rate for a sales manager is 25 UAH; for a workshop worker - 17 UAH; for a delivery manager - 20 UAH; and for a call center operator - 12 UAH.

Task 2 (5 points).

Identify and specify the markers for the diagram built in BPMN notation according to the task. To simplify the simulation, do NOT mark the intermediate and start events of receiving a message (letter).

Task 3 (5 points).

Verify model performance for 3 weeks for BizAgi (500 observations for BIMP).

Analyze three levels of simulation for BizAgi (full simulation for BIMP). Optimize available resources to reduce waiting times. The average waiting time should be no more than 8 minutes, but at the same time, costs should be as low as possible and employee workload should be as high as possible.

Task 4 (5 points).

Build a mind map for the concept of "business process", for example, in https://bubbl.us/ or https://coggle.it/ or https://www.mindmeister.com/ or in programs installed on your computer or in other programs.

Based on the results of the exam, you must generate a report in the format LastName.docx and upload it in the 4th task (regardless of whether the fourth task is completed).

The report file should include (BizAgi):
- mind map;
- a diagram in the BPMN standard;
- simulation results at the 1st stage (only the diagram);
- simulation results at the 3rd stage (diagram);
- information on the number of employees (resources) involved in the final version at stage 3;
- simulation results at stage 3 (report - both tabs);
- general settings at stage 3 (Properties);
- setting up the starting event at stage 3.

Include in the report file (BIMP):
- mind map;
- built diagram in the BPMN standard;
- general settings (Scenario Specification);
- information on the number of employees (Resources) involved in the final version;
- simulation results (Heatmap diagram with waiting time);
- simulation results (Charts - at least: Process waiting times, Resource utilization %);
- simulation results (table Activity Durations, Costs, Waiting times, Deviations from Thresholds).

Assessment criteria

The exam paper consists of four tasks. The final grade for the exam is the sum of the grades for each task.

The **first task** is graded from 0 to 25 points in accordance with the following criteria:

5 points	Defining and displaying all the necessary tracks in the software product
25 points	Building a diagram in BPMN notation in accordance with an individual task

In the case when the task is completed in full, but mistakes were made in its implementation, a part of the points proportional to the work performed in the examination paper is deducted from the maximum score for the task, namely

- up to 3 points are deducted for each group of homogeneous minor errors (i.e., errors that do not reflect a misunderstanding of the notation; for example, incorrect definition of gateways or actions from the point of view of the task, incorrect formation of action names, lack of names of choice alternatives for gateways, etc;

- up to 5 points are deducted for each group of homogeneous significant errors (i.e., those that affect the correct use of the BPMN notation; for example, incorrect definition of the type of objects in the diagram, lack of start and end events, etc.

The **second task** is scored from 0 to 5 points according to the following criteria:

0 points	The task is not completed or is completely incorrect
5 points	Correct definition of markers (in accordance with the task)

In the event that the task is completed in full, but mistakes were made in its execution, a part of the points proportional to the work performed in the examination paper is deducted from the maximum score for the task, namely: up to 0.5 points are deducted for each incorrectly identified or missing marker (except for those for which it is indicated that they should not be set).

The **third task** is evaluated from 0 to 5 points in accordance with the following components:

0 points	The task is not completed or is completely incorrect
5 points	Correct simulation, correctly determined number of required employees

If the task is completed in full, but mistakes were made in its execution, a part of the points proportional to the work performed in the examination paper is deducted from the maximum score for the task.

In cases where the task is partially completed, but is within the specified limits, the examiner may award a multiple of 0.5 for the task.

The **fourth task** is graded from 0 to 5 points according to the following criteria:

0 points	The task is not completed or is completely incorrect
5 points	Correct construction of the mind map

If the task is completed in full, but mistakes were made in its execution, a part of the points proportional to the work done in the examination paper is deducted from the maximum score for the task, namely: all components are not fully defined, information about markers is not indicated, all varieties of defined concepts are not indicated, etc.

In cases where the task is partially completed, but is within the specified limits, the examiner may award a multiple of 0.5 points for the task.

RECOMMENDED LITERATURE

Main

1.   Fundamentals of business process management / M. Dumas-Menijvar, M. La Rosa, J. Mendling, H. Reijers. – Berlin : Springer, 2018. – 496 p.

Additional

2.   Jeston J. Business Process Management. – Abingdon: Routledge, 2018. – 690 p.

3.   Guide to the Business Process Management Body of Knowledge (BPM CBOK® 4.0). – ABPMP International, 2019. – 480 p.

4.   Real-Life BPMN (4th Edition): Includes an Introduction to DMN / J. Freund, B. Rucker. – North Charleston: CreateSpace, 2019. – 232 p.

Information resources

5.   Business Process Management BPMN [Electronic resource]. – Access mode: https://www.udemy.com/courses/search/?src=ukw&q=business+process+management+bpmn

6.   BPMN постер [Електронний ресурс]. – Режим доступу: http://www.bpmb.de/index.php/BPMNPoster.

7.   Business process management for dummies [Electronic resource]. – Access mode: https://www.ibm.com/downloads/cas/B4R8JWK0.

8.   Documents Associated With Business Process Model And Notation (BPMN). Version 2.0 [Electronic resource]. – Access mode: http://www.omg.org/spec/BPMN/2.0/.

9.   IBM Innov8 2.0. – Access mode : http://www-01.ibm.com/software/solutions/soa/innov8/index.html.

10.   Learn BPM – Business Process Management training with BizAgi [Electronic resource]. – Access mode: http://www.bizagi.com/en/learning.

11.   Signavio Process Editor. – Access mode : http://www.signavio.com/products/process-editor/.

12.   Personal learning system "Analysis and optimization of enterprises' business processes" [Electronic resource] - Access mode: https://pns.hneu.edu.ua/course/view.php?id=9929