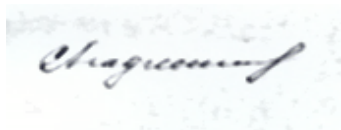


**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
SUMY NATIONAL AGRARIAN UNIVERSITY**

Department of Cybernetics and Informatics

**Approved by
Head of Cybernetics and Informatics Department**



Svitlana V. Agadzhanova

«17» 06 2020y.

SYLLABUS

CONTEMPORARY COMPUTER TECHNOLOGIES IN SCIENCE

Narrow field of education (specialty): All field of education where university is delivering PhD programs

Academic program: All academic programs delivering for III level of higher education (PhD programs)

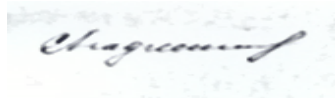
Faculty: Economics and Management

2020 -2021 academic year

Syllabus for course unit “Contemporary computer technologies in science” for PhD students

Developed by:

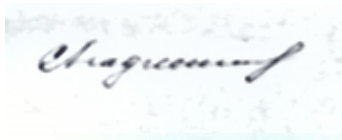
Svitlana V. Agadzhanova – PhD in technical sciences, Assoc. Professor at the Department of Cybernetics and Informatics



The syllabus was approved by Department of Cybernetics and Informatics.

Minutes №10, 17.06.2020

Head of Department of
Cybernetics and Informatics



Svitlana V. Agadzhanova

Agreed:

Head of postgraduate and doctoral studies



Inna V. Lozynska

Methodist of the Department

of Education Quality, Licensing and Accreditation



Iryna D. Skliar

Registered in the university database: 01.07.2020 p.

Description of course unit

ECTS, hours	Narrow field of education, academic program:	Description of the course unit
Amount of ECTS – 3	All field of education where university is delivering PhD programs	Mandatory
	All academic programs delivering for III level of higher education (PhD programs)	Years
		2020 – 2021
		Year of study
		1
		Semester
Total hours – 90		1
Week classes for full day studing: classes – 3 individual - 6	Degree: Doctor of Philosophy	Lectures
		14
		Practical classes
		16
		Labs
		Self-directed study
		60
		Individual tasks
		-
		Forms of Control
		Writing Exam

The share of contact hours for full-time study is 30%,

The share of self-directed study for full-time study – 60%.

2.THE AIM AND OBJECTIVES OF THE COURSE UNIT

Aim: is the formation of postgraduate students' knowledge and skills related to the use of information technology in research; the development of skills in computer programs of text editors and electronic sheets; the disclosure of the essential aspects of the application of computer networks for the tasks of searching for scientific information;

familiarization with the functional capabilities of software tools, intended for scientific analysis of information.

The objectives of this course unit are:

to develop of competences in using of information technologies in scientific research,
to develop both professional and soft skills.

INTENDED LEARNING OUTCOMES OF THE COURSE UNIT

Upon successful completion of this course unit, student will be able to:

- Understand the basic principles of the search, systematization and processing of scientific information with the help of information technology;
- Understand technological bases of functioning of computer networks;
- Explain the essential aspects of statistical analysis;
- Use possibility of registration of scientific reporting with the help of modern software tools;
- Determine the effectiveness of a scientific and design organization;
- Develop and use bibliographic data bases;
- Organize the process of information search by the Internet using search engines;
- Perform a statistical analysis of scientific data;
- Visualize graphically the results of decision by multimedia tools;
- Carry out the preparation of scientific reporting with the help of information technologies.

1. CONTENT

Content module 1. New information technologies. Use of applied software for registration of scientific information

Topic 1. The concept and development of information technology.

The concept of information technology and information. Semantic filling of information in various fields of human activity. Difference between data and information. Approaches to determining the amount of information. Information quality and measurement. Types of new information technologies.

Concepts and types of software: system programs (operating systems, maintenance systems, antivirus software, archivers, tests, drivers); software tools or programming systems (text editors, assemblers, compilers, interpreters, bootloaders or communication editors, control and debugging tools); applications (word processors, table processors, DBMS, graphic editors) and their use in scientific activities. Market classification of software: commercial software, free software, shareware, trial versions, demo version.

Definition of information systems. Classification of information systems. The general structure of information systems, functional and security parts. System's components.

Unified system of primary documentation, concept, composition and requirements. Unique forms of input and output documentation.

Ways of organization and advantages of the concept of databases (DB). The concept, classification and composition of the automated data bank. Characteristics of the logical and physical models of the database. Methods of creating an optimal database model. The theory of normalized relations.

Requirements for using data warehouse in database technology.

Topic 2. Working with structured documents

Possibilities for processing scientific texts in MS Word: formatting the font and paragraph, setting borders and pouring, applying styles, creating footnotes, footers, hyphenation, pointers, automatic content. Creating tables and diagrams, adding pictures. Microsoft Word Publishing Features. Application of OLE technology. Creating Web pages.

Presentation of scientific information in the form of a presentation using the MS Power Point program. Structure and dialog elements. Main menu, standard and custom drawing toolbars. Components of the Power Point presentation. The concept of masters and templates. Objects and markup. Create a new presentation and save it. Typing Editing and formatting text. Using Structures. Add slides to the presentation. Editing slides. The concept of masters and templates. Objects and markup. Presentation view modes. Insert drawings, tables, charts. Create special effects. Formatting text. Demonstration of presentations.

Content module 2. Local and global networks

Topic 3. Computer networks. Global Internet Network

Computer networks. Protocols as sets of rules for exchanging information between computers. Global Internet Network. Use of client / server technology to solve the main task of the Internet - providing the user with the necessary information and services.

Internet addressing system: IP addresses and domains, network identifiers, computer identifiers.

Web Browser: Configuring the user interface, using the horizontal menus and toolbars, replacing the encoding, searching for information using search engines and search directories. Working with electronic libraries.

Rules for working with e-mail and etiquette.

Topic 4. Organization of computer security and information security

An overview of the main methods and scenarios of attacks on a computer user who works on the Internet. Major types of network security violations: the threat of remote administration, the threat of active content, the threat of interception or substitution of data on transportation routes, the threat of interference with privacy, the threat of supply of inappropriate content and the ability to protect against these threats. Viruses and antivirus programs (notion, classification, types). The main ways of infection and methods of protection and treatment.

Methods for protecting local networks from unauthorized access through proxy servers and firewall systems. Data encryption systems and security levels.

Basic concepts and concepts of cryptography. Use of cryptographic systems to protect information on the Internet. Symmetric and asymmetric cryptographic systems. The concept of encrypting data with a dual key. The technology of encryption and digital signature of electronic documents using the PGP package. Certification of public keys, certification centers, selection rules. Blockchain technology.

Content module 3. Fundamentals of statistical processing

Topic 5. Processing of scientific data using Microsoft Excel

The program interface, the use of formulas and rules for working with them. Wizard functions. Application of diagrams for data analysis; types of diagrams, parts editing.

Presentation of scientific data in the form of function graphs; the basis of correlation and regression analysis. Using lists, card forms, sorting and filtering data.

4. Structure of the discipline

Name of content modules and topics	Number of hours					
	total	also				
		Lectures	PC	Labs	IW	
<i>Module 1. Basic concepts of modern information technologies.</i>						
<i>Content module 1. New information technologies. Use of applied software for registration of scientific information</i>						
Topic 1. The concept and development of information technology	14	2	2		10	
Topic 2. Work with structured documents	16	2	4		10	
Total content module 1	30	4	6		20	
<i>Content module 2. Local and global networks</i>						
Topic 3. Computer networks. Global Internet Network	14	2	2		10	
Topic 4. Organization of computer security and information security	14	2	2		10	
Total content module 2	28	4	4		20	
Total module 1	56	8	8		40	
<i>Module 2. Organization of calculations in scientific research using a table processor. Data analysis and visualization of results.</i>						
<i>Content module 3. Fundamentals of statistical processing</i>						
Topic 5. Processing of scientific data using Microsoft Excel	32	6	6		20	
Total module 2	32	6	6		20	
TOTAL	90	14	16		60	

5. Plan of lectures

№	Name of topic	Quantity of hours
1	Topic 1. Information technologies and their role in scientific researches 1. The concept of information technology and information. 2. Classification of software. 3. Use of software in scientific research.	2
2	Topic 2. Work with structured documents 1. Page options. Preview 2. Font design and paragraph formatting 3. Create header footers, footnote 4. Creating an automatic content	2
3	Topic 3. Topic 3. Computer networks. Global Internet Network 1. 1. A comparative overview of modern Internet browsers. 2. Find information in the WWW. 3. Email Etiquette.	2
4	Topic 4. Organization of computer security and information security 1. The concept of computer security. 2. Classification of hardware and software. 3. Technology blockade.	2
5	Topic 5. Processing of scientific data using Microsoft Excel 1. The concept of a database (list) in the MS Excel environment, constraints and features of creation and use. Typical operation of MS Excel databases. 2. Predict values using the "what-if" analysis package. 3. Debug and use the analysis package. Functional overview and examples of use. 4. Analysis of data using the add-in Select Options and Find a solution.	6
	Total	14

6. Practical classes

№	Name of topic	Quantity of hours
1	Practical work 1.Data visualizations in Excel	2
2	Practical work 2. Report information system in Excel	2
3	Practical work 3.Database in Excel	2
4	Practical work 4.Pivot table in Excel	2
5	Practical work 5.Multi-Pivot table in Excel	2
6	Practical work 6.Prediction in Excel	2
7	Practical work 7. Solving linear programming tasks in MS Excel.	2
9	Practical work 8. Transportation problem, solution in MS Excel.	2
	Total	16

7. Tasks for self-directed learning

№ 3/Π	Topics	Quantity of hours
1.	Topic 1. Creating presentations 1. Presentation as a means of presenting ideas. 2. Structure of MS-PowerPoint documents. 3. MS-PowerPoint Program Interface. 4. Stages of presentation development. 5. Working with text, spreadsheets, charts, multimedia elements. 6. Presentation management. <i>Recommended sources:</i> https://support.microsoft.com/en-us/office/create-a-presentation-in-powerpoint-422250f8-5721-4cea-92cc-202fa7b89617 ; https://prezi.com/ https://www.mindmeister.com/	10
2.	Topic 2. Basics of work in the environment of the table-top processor MS Excel. 1. History of creating and developing table processors. 2. The main areas of IT use. 3. Tabbed Processor Interface. 4. Select the areas of the table. 5. Deleting information. 6. Copy, move. 7. Editing cell values Formatting cells. 8. Types of data in MS Excel. <i>Recommended reading: Modern information technologies in science researches course book for English-Speaking Students, 1-st year graduate students; Lindsay, John (2016). Information Systems – Fundamentals and Issues. Kingston University;</i> https://zapier.com/apps/excel	10

	https://www.google.com/sheets/about/	
3.	Topic 4. Creating, editing and formatting spreadsheets. 1. Typical operations for editing the spreadsheet data: changing and editing cell contents; Copy the block of cells into one or more areas of the table; moving block of cells; delete block of cells; insert cell block. 2. Typical formatting operations for spreadsheet data: debugging data formats; change the type, size, and font colors; aligning cell contents and framing; protect cells, sheets and workbooks. Set page options: numbering pages; header footer insertion and more. Preview and print tables. 3. Manage files (books) in the MS Excel environment. Creating a new file, loading an existing one, saving a file under a new name, opening the file, searching the file for the specified attributes. <i>Recommended reading: Modern information technologies in science researches course book for English-Speaking Students, 1-st year graduate students; https://zapier.com/apps/excel https://www.google.com/sheets/about/</i>	20
4.	Topic 5. Creating, editing and formatting graphs and charts. 1. Purpose and basic concepts and objects Designer diagrams: the concept of a diagram, a series of data, category, legend, marker, axis of values, area of the diagram, area of diagram construction. 2. Creating and drawing diagrams. Diagonal Designer Interface Dialog Box. Diagramming modes: in the worksheet of a table, in a separate sheet of diagrams. Configure parameters and print charts. <i>Recommended reading: Modern information technologies in science researches course book for English-Speaking Students, 1-st year graduate students; https://zapier.com/apps/excel https://www.google.com/sheets/about/</i>	20
	Total	60

8. TEACHING AND LEARNING METHODS USED IN THE COURSE

Lectures-discussions, "flipped class", case study, brainstorming, peer-to-peer learning, peer-to-peer assessment, teamwork.

9. ASSESSMENT METHODS

Formative assessment: Lecturer gives students descriptive feedback every class. The results of the first module (written test) adds students' awareness of the level of their progress.

Summative assessment is aimed to assessing the level of achieving the intended learning outcomes through the assessment of presentations, the implementation of written tasks.

Assessment on a 100-point scale (distribution of points in section 11)

10. Distribution of points received by students

Current assessment and self-directed learning					self-directed	Sum	Summutive exem	Total
Topics								
T1	T2	T3	T4	T5	40	70	30	100
	10	10	10					

11. Assessment scale: national and ECTS

Total points	ECTS	National rating
		Exams, term paper, practice
90 – 100	A	Excellent
82-89	B	Good
75-81	C	
69-74	D	
60-68	E	Satisfactory
35-59	FX	Unsatisfactory
1-34	F	Poor

RECOMMENDED READING

1. *Modern information technologies in science researches course book for English-Speaking Students, 1-st year graduate students/ S.Agadzhanova, N.Barchenko, L.Taranjuk/ [Text] /Lecture notes for English-speaking Students, 1-st year graduate students. SNAU, Sumy - 2018. - 96 P.*
2. *Agadzhanova, S., Barchenko, N., Lecture notes for English-speaking Students of Economics and Management Faculty, 1st year study master's degree, specialty: 073 Management, EP "Administrative management". September, 2018. - 96 p.*
3. *Kenneth C. Laudon and Jane Price Laudon. Management Information Systems: Organization and Technology, 6th edition, by Kenneth C. Laudon and Jane Price Laudon, produced by Prentice-Hall, a division of Pearson Education.*
4. *Rainer, R. Kelly and Cegielski, Casey G. (2019). "Introduction to Information Systems: Enabling and Transforming Business, 3rd Edition"*
5. *S.Agadzhanova Operations research: конспект лекцій. Суми, 2018 рік, ст.72, табл.14, рис.34. Рекомендовано до видання методичною радою факультету економіки і менеджменту. Протокол №6 від 23.05.2018р.*
6. *About Operations Research. INFORMS.org. Retrieved 7 January 2012.*
7. *Mathematics Subject Classification. American Mathematical Society. 23 May 2011. Retrieved 7 January 2012.*
8. *What is OR. HSOR.org. Retrieved 13 November 2011.*
9. *Operations Research Analysts. Bls.gov. Retrieved 27 January 2012.*

10. *OR / Pubs / IOL Home. INFORMS.org. 2 January 2009. Archived from the original on 27 May 2009. Retrieved 13 November 2011.*
11. *M.S. Sodhi, What about the 'O' in O.R.? OR/MS Today, December, 2007, p. 12, <http://www.lionhrtpub.com/orms/orms-12-07/frqed.html>*
12. *Operations research (industrial engineering) :: History – Britannica Online Encyclopedia". Britannica.com. Retrieved 13 November 2011.*
13. *Frederick S. Hillier & Gerald J. Lieberman, Introduction to Operations Research, McGraw-Hill: Boston MA; 10th Edition, 2014*
14. *Lindsay, John (2016). Information Systems – Fundamentals and Issues. Kingston University, School of Information Systems.*
15. *Dostal, J. School information systems (Skolni informacni systemy). In Infotech 2017 - modern information and communication technology in education. Olomouc, EU: Votobia, 2017. p. 540 – 546. ISBN 978-80-7220-301-7.*
16. *O'Leary, Timothy and Linda. Computing Essentials Introductory 2018. McGraw-Hill on Computing 2018.com.*