

SYLLABUS

1. General information on the course

Full course name	Medical Informatics
Full official name of a higher education institution	Sumy State University
Full name of a structural unit	Faculty of Electronics and Informational Technologies. Department of Applied Mathematics and Complex Systems Modeling
Author(s)	Shvets Uliana Stanislavivna, Dvornychenko Alina Vasylivna
Cycle/higher education level	The Second Level Of Higher Education, National Qualifications Framework Of Ukraine – The 7th Level, QF-LLL – The 7th Level, FQ-EHEA – The Second Cycle
Semester	20 weeks during 4-th semester
Workload	The volume of the discipline is 3 ECTS credits, 90 hours, 36 hours is contact work with the teacher (36 hours of practical work), 54 hours - independent work.
Language(s)	English

2. Place in the study programme

Relation to curriculum	Compulsory course available for study programme "Medicine"
Prerequisites	Medical and Biological Physics, Medical Biology, Physiology
Additional requirements	There are no specific requirements
Restrictions	There are no specific restrictions

3. Aims of the course

The aim of the discipline is the formation and development of competence of future doctors in the field of computer information technology to ensure the rational usage of modern general and special purpose software during medical and biological data.

4. Contents

Topic 1 Fundamentals of Information Technology in Health Care.

Safety. Introduction and course structure of medical informatics. The aim of the discipline. The main tasks and components of medical informatics. Data and information, types of information. Communication. Internet.

Topic 2 Coding and Classification of Medical Data.

Classification. Thesaurus, coding, code, types of codes. International Classification of Diseases (ICD-11).

Topic 3 Creation of Medical Documentations.

Medical information, medical data, features of medical data, medical documentation, application software.

Topic 4 Analysis of Biosignals. Methods of Processing Biosignals. Visualization of Biomedical Data. Processing of Medical Images.

Analysis of biosignals. Registration, transformation and classification of signals. Data transmission standard, DICOM format. The problem of image processing and analysis. Image transformation. Modern trends in image processing. Processing of two-dimensional and three-dimensional medical images (computed tomography, magnetic resonance imaging, digital radiography, angiography, ultrasound methods).

Topic 5 Processing Medical Research Data by MS Excel.

Spreadsheet. Automation of calculations (relative and absolute references, formula, function). Graphical representation of data, results of medical researching. Working with an elementary database. Database, record, field. Sorting, filtering, calculation of intermediate results.

Topic 6 Formalization and Algorithmization of Medical Problems. Formal Logic in Solving Problems of Diagnosis, Treatment and Prevention of the Diseases.

Fundamentals of algorithmization of medical problems. Algorithms and their properties. Ways to present algorithms. Types of algorithms. Drawing up a block diagram of a simple and branched algorithm. Drawing up a block diagram of an algorithm with an internal cycle. Logical operations. Algebra of logic. Statements, logical function. Logical functions in MS Excel.

Topic 7 Modeling of Medical and Biological Processes.

Model, modeling. Types of models. Mathematical model. Model quality indicators. Stages of mathematical modeling. Mathematical models of biological systems and medical-biological processes.

Topic 8 Evidence-Based Medicine. Principles of Evidence-Based Medicine.

Definition of evidence. System research. Randomized controlled clinical testing. System review, meta-analysis. Cochrane Electronic Library. Operational characteristics of the diagnostic method (sensitivity, specificity, accuracy of results; predictability of positive results, predictability of negative results). Interpretation of operational characteristics of the diagnostic method.

Topic 9 The Usage of Relative Values in Medical Research.

Absolute value. Relative value. Extensive indicator, intensive indicator, visibility indicator, ratio indicator. Graphical representation of indicators. Interpretation of values of relative quantities.

<p>Topic 10 Methods in Biostatistics.</p> <p>Random variable. The general population. Sample. Descriptive statistics. Measures of the central tendency (average, median, fashion). Measures of variability (variance, minimum, maximum values, scope, standard error). Normal distribution law. Identification the relation of two random variables. Correlation analysis. Interpretation of correlation analysis results.</p>
<p>Topic 11 Information Technologies for Approximation and Forecasting of Statistical Medical Data.</p> <p>Functional approximation, regression analysis of data. Linear regression equation. Estimation of reliability of coefficients of linear model. Estimation of informativeness and significance of regression equation. Spot chart, trend line. Prognostication.</p>
<p>Topic 12 Medical Information Systems.</p> <p>General technological scheme of medical-diagnostic process. Medical information systems and environments. Classification of medical information systems. Expert systems. Structure and functioning of the expert system. Classification of expert systems. Automated workplace. Electronic health care system.</p>
<p>Topic 13 Final Modular Control.</p> <p>Compilation of final control over test technologies and / or performance of a complex practical task.</p>

5. Intended learning outcomes of the course

After successful study of the course, the student will be able to:

LO1	To use effectively modern technics of searching professional information, general and special software in the field of health care.
LO2	To develop independently software various purposes, update and integrate acquired knowledge.
LO3	To analyze, evaluate, identify of patterns and trends in public health indicators, the state and dynamics of development of health care facilities.
LO4	To optimize the provision of medical care to the population, the work of health care facilities through the usage of modern software and computer information technology.

6. Role of the course in the achievement of programme learning outcomes

Programme learning outcomes achieved by the course.

For 222 Medicine:

PO2	To collect information about the patient's general condition; to assess the patient's psychomotor and physical development and the state of organs and systems of the body; to assess information on the diagnosis (according to the List 4) based on laboratory and instrumental findings.
PO3	To order and analyze additional (mandatory and optional) examinations (laboratory, radiological, functional and/or instrumental) (according to the List 4) in order to perform a differential diagnosis of diseases (according to the List 2).

PO4	To establish a final clinical diagnosis at a medical institution under control of a supervising doctor by means of informed decision and logical analysis of the obtained subjective and objective data of clinical and additional examinations, and differential diagnosis, following the relevant ethical and legal norms (according to the List 2).
PO18	To search for the necessary information in the professional literature and databases; to analyze, evaluate, and apply this information. To apply modern digital technologies, specialized software, statistical methods of data analysis to solve complex health problems.
PO22	To communicate one's knowledge, conclusions, and arguments on health issues and related concerns clearly and unambiguously to professionals and non-specialists, in particular to students.
PO25	To make effective healthcare decisions assessing resources and considering social, economic, and ethical implications.

7. Teaching and learning activities

7.1 Types of training

Topic 1. Fundamentals of Information Technology in Health Care.
pr.tr.1 "Safety. Introduction and Structure of Medical Informatics." (full-time course) Safety. The aim, structure and objectives of the course.
Topic 2. Coding and Classification of Medical Data.
pr.tr.2 "International Classification of Diseases." (full-time course) International Classification of Diseases (ICD-11). The main elements of the classifier. Finding out the mechanism of coding and uncoding the diagnosis.
Topic 3. Creation of Medical Documentations.
pr.tr.3 "Development and Completion of Electronic Forms." (full-time course) Creation, development of electronic form. Field (test, numeric, list, check box). Field properties. Form protection. Filling out the form.
pr.tr.4 "Organization of the Appearance of the Document." (full-time course) Test formatting. Lists. Tabs. Search and replace text. Table. Adjust page settings. Content. Footer. Bookmark. Cross-reference. Footnote. Page numbering. Column. Insert objects into a document. Formula. Document protection.
Topic 4. Analysis of Biosignals. Methods of Processing Biosignals. Visualization of Biomedical Data. Processing of Medical Images.

pr.tr.5 "Visualization of Medical and Biological data. Processing and Analysis of Medical Images." (full-time course)

Data transmission standard, DICOM format. Modern trends in image processing. Processing of two-dimensional and three-dimensional medical images (computed tomography, magnetic resonance imaging, digital radiography, angiography, ultrasound). View and visual analysis of medical images.

Topic 5. Processing Medical Research Data by MS Excel.

pr.tr.6 "Processing of Medical Research Data in MS Excel. Construction of Tables. Formulas." (full-time course)

Spreadsheet. Automation of calculations (relative, absolute reference, formula, function).

pr.tr.7 "Processing of Medical Research Data in MS Excel. Construction and Editing of Diagrams." (full-time course)

Graphical representation of data, results of medical researches. Chart. Types of diagrams. Creating and editing charts.

pr.tr.8 "Working with Elementary Databases." (full-time course)

Working with an elementary database. Database, record, field. Sorting, filtering, calculation of intermediate results.

Topic 6. Formalization and Algorithmization of Medical Problems. Formal Logic in Solving Problems of Diagnosis, Treatment and Prevention of the Diseases.

pr.tr.9 "Formalization and Algorithmization of Medical Problems." (full-time course)

Algorithms and their properties. Ways to present algorithms. Types of algorithms. Drawing up a block diagram of a simple and branched algorithm. Drawing up a block diagram of an algorithm with an internal cycle.

pr.tr.10 "Formal Logic in Solving Problems of Diagnosis, Treatment and Prevention of the Diseases." (full-time course)

Statements, logical function. Logical functions in MS Excel.

Topic 7. Modeling of Medical and Biological Processes.

pr.tr.11 "The Usage of Mathematical Modeling in Medicine." (full-time course)

Stages of mathematical modeling. Mathematical models of biological systems and medical-biological processes.

Topic 8. Evidence-Based Medicine. Principles of Evidence-Based Medicine.

pr.tr.12 "Health Care Information Resources." (full-time course)

Characteristics and features of information resources of the health care system. Basics of telemedicine. Evidence-based medicine. Principles of evidence-based medicine. Systematic reviews. Meta-analysis. Cochrane database.

<p>pr.tr.13 "Determination of Indicators of Efficiency of Usage of Diagnostic Researches at a Certain Disease." (full-time course)</p> <p>Calculation of operational characteristics (sensitivity, specificity, accuracy of results; predictability of positive results, predictability of negative results). Interpretation of results.</p>
<p>Topic 9. The Usage of Relative Values in Medical Research.</p>
<p>pr.tr.14 "Relative Values and Their Charts." (full-time course)</p> <p>Calculation and graphical representation of relative values (extensive indicator, intensive indicator, clarity indicator, ratio indicator). Interpretation of values of relative quantities.</p>
<p>Topic 10. Methods in Biostatistics.</p>
<p>pr.tr.15 "Descriptive Statistics. Identifying the Relationship of Two Random Variables." (full-time course)</p> <p>Descriptive statistics. Normal distribution law. Correlation analysis. Correlation coefficient. Depth and direction of correlation. Interpretation of correlation analysis results.</p>
<p>Topic 11. Information Technologies for Approximation and Forecasting of Statistical Medical Data.</p>
<p>pr.tr.16 "Information Technologies for Approximation and Forecasting of Statistical Medical Data." (full-time course)</p> <p>Linear regression equation. Estimation of reliability of coefficients of linear model. Estimation of informativeness and significance of regression equation. Spot chart, trend line. Prognostication</p>
<p>Topic 12. Medical Information Systems.</p>
<p>pr.tr.17 "Medical Information Systems." (full-time course)</p> <p>General technological scheme of medical-diagnostic process. Medical information systems and environments. Classification of medical information systems. Expert systems. Structure and functioning of the expert system. Classification of expert systems. Automated workplace. Electronic health care system.</p>
<p>Topic 13. Final Modular Control.</p>
<p>pr.tr.18 "Final Modular Control." (full-time course)</p> <p>Compilation of final control over test technologies and / or performance of a complex practical task.</p>

7.2 Learning activities

LA1	Preparation for practical classes
LA2	Execution and presentation of the results of practical work
LA3	Performing situational exercises
LA4	Preparation of multimedia presentations
LA5	E-learning in Google Classroom, Google Meet, MIX, elearning systems

LA6	Self-study
LA7	Preparation for the final control

8. Teaching methods

Course involves learning through:

TM1	Demonstration method
TM2	Practice-oriented learning
TM3	Problem-searching method

Practical classes provide a theoretical basis, which is the basis for self-study of students, allow one to apply the acquired knowledge to solve practical problems (LO1-LO4). The preparation for practical classes facilitates a self-study. A work in small groups allows to prepare presentations that will be presented to other groups, and then analyzed and discussed. Reproductive methods are focused on the ability to reproduce the acquired knowledge to solve typical problems through the usage of algorithms, instructions, guidelines. Productive teaching methods, in particular, problem-based, interactive teaching allow one to create conditions for activating thinking, making creative decisions, increased student motivation.

GC 1.Ability to abstract thinking, analysis, and synthesis. GC 2.Ability to learn, master modern knowledge, and apply the knowledge in practice. GC 3.Knowledge and understanding of the subject area and professional activity comprehension. GC 7.Ability to use information and communication technologies.

9. Methods and criteria for assessment

9.1. Assessment criteria

ECTS	Definition	National scale	Rating scale
	Outstanding performance without errors	5 (Excellent)	$170 \leq RD \leq 200$
	Above the average standard but with minor errors	4 (Good)	$140 \leq RD < 169$
	Fair but with significant shortcomings	3 (Satisfactory)	$120 \leq RD < 139$
	Fail – some more work required before the credit can be awarded	2 (Fail)	$0 \leq RD < 119$

9.2 Formative assessment

FA1	Teacher's instructions in the process of performing practical tasks
FA2	Interviews and oral comments of the teacher on his results
FA3	Independent performance of situational exercises by students in practical classes and their discussion
FA4	Presentation protection

9.3 Summative assessment

SA1	Checking the implementation of practical tasks.
SA2	Compilation of the final modular control.

Form of assessment:

4 semester	200 scores
SA1. Checking the implementation of practical tasks.	120
	120
SA2. Compilation of the final modular control.	80
	80

Form of assessment (special cases):

4 semester	200 scores
SA1. Checking the implementation of practical tasks.	120
	120
SA2. Compilation of the final modular control.	80
	80

Control measures in a special case: The assessment of the applicant in the discipline is the result of the sum of the current assessment and the compilation of the final module control. The current assessment during the semester is conducted in the form of defense of practical tasks on a traditional 4-point scale ("2", "3", "4", "5"). Defense of work provides: performance of a standard task, performance of an individual (group) task, formation of the report (presentation). Individual tasks must be performed independently, similar work will be rejected. The number of points for current academic activity is the result of converting the arithmetic mean obtained by the applicant during the semester into a 120-point scale according to the table "Regulations on assessing the educational activities of students of SSU Medical Institute on credit-transfer system of educational process." The final modular control work is carried out according to test technologies and / or is a complex task. Applicants who have completed all types of educational work during the academic period, completed all missed classes and scored at least 72 points based on the results of the current success are admitted to the final module control.

10. Learning resources

10.1 Material and technical support

MTS1	Computers, computer systems and networks
MTS2	Software (to support distance learning, online survey)
MTS3	Application software (MS Office)
MTS4	Library funds
MTS5	Multimedia, video and sound reproduction, projection equipment (video cameras, projectors, screens, smart boards, etc.)

10.2 Information and methodical support

Essential Reading	
1	Medical informatics / I. Y. Bulakh, Y. Y. Liakh, V. P. Martseniuk, I. Y. Khaimzon. - 3rd edition, revised. - K. : AUS Medicine Publishing, 2017.- 368 p.
2	Medical Informatics in Modules : study guide / I. Y. Bulakh, L. P. Voitenko, O. S. Alita etc. - 2nd edition, revised. - K. : AUS Medicine Publishing, 2018. - 152 p.
Supplemental Reading	
3	Biomedical Informatics [Електронний ресурс] : Computer Applications in Health Care and Biomedicine / edited by Edward H. Shortliffe, James J. Cimino. - 4th ed. 2014. - London : Springer London, 2014.
4	Methodical instructions for practical training "Processing medical research data by MS EXCEL" on the discipline "Medical Informatics" ... / A. V. Dvornichenko, U. S. Shvets. - Sumy : Sumy State University, 2021. - 30 p.
5	Methodological Instructions for Practical Training "A Creation of Medical Documentation with the Help of MS Word 2016" on the Discipline "Medical Informatics" : ... / A. V. Dvornichenko, U. S. Shvets. - Sumy : Sumy State University, 2020. - 73 p.
8	Methodological instructions for the Home Assignment Project on the discipline "Informatics" : for students of economic, medical and IT specialties / T. O. Marynych. - Sumy : Sumy State University, 2018. - 45 p.