



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Medical Informatics [S2ETI2>IM]

### Course

Field of study

Education in Technology and Informatics

Year/Semester

2/3

Area of study (specialization)

–

Profile of study

general academic

Level of study

second-cycle

Course offered in

Polish

Form of study

full-time

Requirements

elective

### Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

0

### Number of credit points

2,00

### Coordinators

dr hab. inż. Szymon Wilk prof. PP  
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### Lecturers

### Prerequisites

Basic knowledge of informatics, statistics, data analysis, and physics acquired during first-cycle studies. Ability to apply the mathematical knowledge acquired during first-cycle studies to the analysis of models and algorithms; ability to obtain information from designated sources. Understanding of the need of enhancing personal competencies.

### Course objective

1. Providing students with basic knowledge in medical informatics, mainly related to medical data and methods of its acquisition (diagnostic devices), coding, standardization, storage, sharing, advanced analysis, and presentation. 2. Providing students with basic knowledge about the characteristics and organization of healthcare units from the perspective of the employed IT systems used and their architecture. 3. Familiarizing students with examples of IT systems and programming tools used in medicine.

### Course-related learning outcomes

Knowledge:

1. Student has advanced and detailed knowledge of selected issues in medical informatics.

2. Student is familiar with advanced methods, techniques, and tools used in solving complex engineering tasks in medical informatics.

Skills:

1. Student is able to obtain information on medical informatics from literature, databases, and other sources, integrate it, interpret it, and critically evaluate it.
2. Student is able to select and apply appropriate methods and tools, including advanced information and communication technologies and scientific studies on specific issues in the field of medical informatics.

Social competences:

1. Student is ready to critically evaluate their knowledge and the content they receive in the field of medical informatics and understands the need for lifelong learning.
2. Student is ready to recognize the importance of knowledge in solving cognitive and practical problems in medical informatics and to seek expert advice.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge and skills acquired during the course are verified by a 45-minute exam, consisting of 5-10 questions (test and open), with diversified scores. Passing threshold is 50% of overall score. Issues and topics considered when developing the questions will be sent to students by the eKursy system. In the case of a small number of students, it is possible to change the form of the exam from written to oral.

### Programme content

The first part of the lecture is devoted to introducing and presenting types of medical data, their sources, and specific characteristics. Integrated hospital information systems and important medical standards used for coding and transmitting non-imaging data, including HL7, SNOMED CT, LOINC, MeSH, and ICD, are discussed.

The second part of the course discusses selected medical devices for laboratory, signal, and imaging diagnostics. The first category presents devices that perform selected types of laboratory tests, as well as LIS (Laboratory Information Systems) that integrate laboratory diagnostic devices. The second category includes diagnostic devices that generate multidimensional time series (EEG, ECG). The third category concerns imaging diagnostic devices, including traditional X-ray diagnostics (RTG), computed tomography (CT), and magnetic resonance imaging (MRI). The discussion of diagnostic devices is supplemented by a discussion of selected aspects of diagnostic data processing and analysis, algorithms used in these processes, and a presentation of related standards and IT solutions, including PACS (Picture Archiving and Communication Systems) medical imaging databases, RIS (Radiology Information Systems), and the DICOM (Digital Imaging and Communication in Medicine) standard.

The third part of the lecture is devoted to the application of advanced data analysis techniques in medicine, including artificial intelligence, machine learning, and knowledge discovery methods. Examples of clinical decision support systems, including mobile systems, as well as IT solutions for effective information retrieval, supporting the paradigm of evidence-based medicine, are presented.

### Course topics

Approximate lecture plan:

- medical informatics - introduction, characteristics of medical data,
- hospital information systems,
- HL7, SNOMED CT, LOINC, ICD, MeSH standards,
- diagnostic devices - introduction and laboratory diagnostics,
- signal diagnostics: EEG, ECG,
- imaging diagnostics: X-ray, CT, MRI,
- DICOM standard, PACS and RIS systems,
- clinical decision support using artificial intelligence and machine learning techniques (expert and learning systems),
- information retrieval in clinical repositories,
- telemedicine and telemonitoring.

## Teaching methods

Multimedia presentation, solving simple problems on a whiteboard.

## Bibliography

Basic:

1. E.H. Shortliffe, J.J. Cimino (red.): Biomedical Informatics: Computer applications in Health Care and Biomedicine. Springer, 2021.
2. R. Tadeusiewicz: Informatyka medyczna. Wydawnictwo UMCS, 2011 (darmowy e-book: [http://otworzksiazke.pl/ksiazka/informatyka\\_medyczna/](http://otworzksiazke.pl/ksiazka/informatyka_medyczna/)).

Additional:

1. W. Hersh (red.): Health Informatics: Practical Guide, LuLu 2022.
2. T.A. Cohen, V.L. Patel, E.H. Shortliffe: Intelligent Systems in Medicine and Health, Springer 2022.
3. A. Winter, E. Ammenwerth, R. Haux, M. Marschollek, B. Steiner, F. Jahn: Health Information Systems. Technological and Management Perspectives. Springer 2023.
4. T. Benson, G. Grieve: Principles of Health Interoperability. SNOMED CT, HL7 and FHIR. Springer, 2016.
5. Sz. Wilk, M. Kezadri-Hamiaz, D. Amyot, W. Michalowski, C. Kuziemy, N. Catal, D. Rosu, M. Carrier, R. Giffen, An Ontology-driven Framework to Support the Dynamic Formation of an Interdisciplinary Healthcare Team, International Journal of Medical Informatics, vol. 136, 2020, 104075.
6. P. Liskowski, K. Krawiec: Segmenting Retinal Blood Vessels with Deep Neural Networks. IEEE Transactions on Medical Imaging, vol. 35, no. 11, 2016, 2369-2380.

## Breakdown of average student's workload

|   | Hours | ECTS |
|---|-------|------|
| Total workload  | 50    | 2,00 |
| Classes requiring direct contact with the teacher   | 30    | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 20    | 1,00 |