



# Module Description

## Medical Informatics

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## MI-01 FWP\*

Module code	MI-01
Module coordination	Prof. Dr. Georgi Chaltikyan
Modul?gruppe	FWP
Course number and name	MI-01 FWP-1: Medicine for Non-Physicians MI-01 FWP-2: Computer Science for Medics
Lecturers	Prof. Dr. Georgi Chaltikyan Prof. Dr. Horst Kunhardt Christian Roth
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	compulsory course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

## Module Objective

### Learning Outcomes of the Module:

#### Medicine for Non-Physicians:

The overall goal of the module is to enable the student with little or no previous knowledge in biomedicine to understand the construction and major functions of the human body; to recognize the most important functional relationships in normal and diseased human body as a basis for preventive and therapeutic interventions.

After completion of this module the student will have achieved the following learning objectives:

Professional competences:

- Knowledge of basic anatomy, physiology and medical terminology;
- Knowledge of the most important biomedical subjects and specialties;
- Knowledge of the most common diseases and conditions;



- Basic knowledge of diagnoses and therapies;
- Understanding of disease management and health promotion.

Methodical expertise:

- Understand, analyze and synthesize information about health and disease;
- Communicate with healthcare providers (understand their thought structure and speak about the management of a particular patient);
- Discuss important clinical and public health issues, such as treatment and prevention of some diseases.

Personal competences:

- Construct simple descriptions of structure and functions of the human body;
- Capture and transmit the medical terminology.

Social competences:

- Working in small groups discussing and presenting overview and case studies of particular diseases or conditions.

### **Computer Science for Medics:**

Students should become aware of the fundamental aspects and current technologies of computer science. Students will be able to analyze the complexity of tasks and analyze the advantages and disadvantages of development process layouts and technology related to their context. Furthermore, students will learn the interplay of IT customers, stakeholders, developers and operators and how modern development processes support companies and organizations to establish an effective and efficient product development or IT department that fulfills medical standards and satisfies their customers and stakeholders. Another big topic faces the students with software design and software programming. Students will be able to recognize the relevance of design principles and object-oriented programming. Beside this the course provides insights and key concepts of network technology, network and data security, hardware modules, operating systems and especially databases.

Students are presented with a broad picture of the various aspects of applied computer science. The module teaches the theory of computer science and information technology and adapts it for the domain of medical engineering and hospital IT. The module serves as a fundamental module for master students of different domains. It faces the students with relevant aspects and concepts of computer science and information technology and provides fundamental IT knowledge for other modules, e.g. data security and network technologies. The module consists of the theoretical part and practical lab training, and allows the students to apply the theoretical knowledge to practical use cases.



Professional competence:

- o Understanding of the different parts of a computer. Students will be able to identify important parts of a computer like system memory, mass storage and processors and are able to explain how these parts work together within a computer system.
- o Knowledge about network topology and technology. Students can explain how IP based networks work and compare them with non-IP based proprietary networks.
- o Knowledge of the main concepts of product development and IT processes. Especially knowledge about the development of software and IT systems for the application in medical environments. Students can identify and explain differences between existing concepts and apply them in their working environment. They will be able to identify and analyze process obstacles and to derive suggestions for the implementation of an improved process. Students will be able to detect domain borders between stakeholders, customers, product management, developers and sales and to evaluate concepts that target to reduce such borders.
- o Understanding of abstraction and abstraction layers in software/hardware development. Students are able to recognize the importance and relevance of abstraction mechanisms in system development. They are able to explain differences between hardware, firmware and software and they are also able to explain advantages and disadvantages of implementing features of a system in hardware, firmware or software. Students are able to apply design principles to solve real world issues and construct modular and maintainable software designs.
- o Understanding of imperative programming. Students can describe the difference between procedural programming and object-orientated programming.
- o Knowledge of database systems and database design. Students will be able to identify to create relational database designs that avoid data loss and data inconsistency. They are able to explain how a relational database stores data.
- o Understanding of the different parts of an operating system. Students are able to recognize the relevance of operating systems as an abstraction mechanism and they are able to explain tasks of an operating system.
- o

Methodical and practical expertise:

- o Ability to implement small computer programs in Java. Students understand the syntax of Java and other programming languages with similar syntax.
- o Ability to create queries for relational databases. Students are able to read and write SQL queries.



- o Ability to create requirements documents. Students are able to analyze user requirements, to identify stakeholders in development processes, to identify tacit knowledge and to process user requirements to formalized documents.
- o Ability to execute object orientated analysis and design. Students are able to explain and use certain object-oriented patterns like Facade or Factory.
- o Ability to transfer theoretical knowledge of computer science and legal issues to real world use cases of medical engineering and hospital IT.

Personal competence:

- o Ability to understand the complexity of development and IT projects and products. The students will be able to recognize that often there are no “one fits all” solutions. They will be able to show that design decisions have often pros and cons and students will be able to identify and analyze these pros and cons.
- o Students learn by practical examples that different persons have often very different understanding about same things. They will be able to identify different understandings and to avoid misunderstandings by creation of formalized documents.

Social competence:

- o Understanding of humans as key factor in development processes. Students learn that humans are not machines and machines are not humans. Students will be able to recognize why satisfaction, motivation and qualification of employees are key factors of successful implementations of development processes. Students are able to decide whether a workload can be better executed by a machine or manual by a human.

## Applicability in other Programs

### Medicine for Non-Physicians:

The module provides a basis for healthcare-related modules in all study programs of the Faculty of Applied Health Sciences.

### Computer Science for Medics:

Can be used in any other study program in the field of Health IT.

## Learning Content

### Contents of the Module:

#### Medicine for Non-Physicians:

1. The Human Body: from Cell to Organism: Structure of the living organisms; Functions of the living organisms; Basics of metabolism; Molecular composition;



Cell structure and function; Genes and heredity; Basics of embryology; Tissues of the human body; Organs and organ systems; Body parts, cavities and planes.

2. The Framework of Medicine and Healthcare: Historic highlights and recent advances in medicine; Health: definitions, components, approaches, promotion; Disease: definitions, terminologies, categories, classification; Basics of clinical practice; History and physical examination; Diagnostic modalities; Treatment and rehabilitation; Prevention (prophylaxis); Medical professions and careers.
3. Overview of Human Organ Systems: Basic Anatomy and Physiology, Common Diseases, Diagnostic Tests, Treatment Modalities:
  - 3.1. Musculoskeletal System;
  - 3.2. Nervous System;
  - 3.3. Skin and Sense Organs;
  - 3.4. Cardiovascular System;
  - 3.5. Blood, Lymph and Immune System;
  - 3.6. Respiratory System;
  - 3.7. Digestive System;
  - 3.8. Endocrine System and Metabolism;
  - 3.9. Urinary System;
  - 3.10. Reproductive System.
4. Special topics in Medicine and Surgery: Accidents and Injuries; Tumors and Oncology; Infection / Inflammation / Sepsis; Organ Transplantation.
5. Biomedical Innovation and Research, Current Trends and Future of Medicine (stem cells, genetics and personalized medicine, HIT and AI, 3D-printed organs).

**Computer Science for Medics:**

1. Product and IT development processes
  - 1.1 Traditional development models
  - 1.2 History of lean management and lean development
  - 1.3 Principles of lean product development
  - 1.4 Agile (software) development
2. Software development and programming



- 2.1 Hardware, Firmware, Software
- 2.2 Requirements engineering
- 2.3 Design and refactoring principles
- 2.4 Programming languages, formal languages
- 2.5 Notations and syntax
- 2.6 Procedural programming
- 2.7 Object-oriented programming
- 3. Software architecture
  - 3.1 Design patterns
  - 3.2 UML
  - 3.3 Model driven architecture
  - 3.4 Aspects of scalability
- 4. Networks
  - 4.1 Network abstraction layers
  - 4.2 Network topology
  - 4.3 IP based networks
  - 4.4 Domain specific networks (PAN, CAN)
  - 4.5 General network protocols
  - 4.6 Hardware
- 5. Computer hardware
  - 5.1 Processors CPU, GPU
  - 5.2 Multi Core and multi threading systems (SMT)
  - 5.3 System memory
  - 5.4 Storage
  - 5.5 (Hardware) RAID
  - 5.6 Backup systems and strategies
- 6. Databases





6.1 Principles of relational databases

6.2 Normal form

6.3 Tables, Keys and Joins

6.4 SQL, T-SQL

6.5 NoSQL Databases

7. Operating Systems

7.1 Usage

7.2 Hardware abstraction

7.3 Parts of operating systems

7.4 Kernel architectures

## Teaching Methods

### Medicine for Non-Physicians:

Lectures, seminar discussions, case studies, student presentations.

### Computer Science for Medics:

Lectures, exercises, practical work at PC lab.

## Remarks

### Medicine for Non-Physicians:

Visit to a healthcare facility.

## Recommended Literature

### Medicine for Non-Physicians:

- o Davi-Ellen Chabner: "The Language of Medicine", 11th edition. Elsevier, 2014. ISBN: 978-1455728466.
- o Davi-Ellen Chabner: "Medical Terminology: A Short Course" 7th edition. Elsevier, 2015. ISBN: 978-145575830-2.
- o G. S. Thompson: „Understanding Anatomy & Physiology: A Visual, Auditory, Interactive Approach“, 2nd Edition. Davis, 2015. ISBN: 978-0803643734.



- o Renate Huch, Klaus D. Jürgens: "Mensch, Körper, Krankheit: Anatomie, Physiologie, Krankheitsbilder", 7<sup>th</sup> edition. Urban & Fischer Verlag/Elsevier GmbH, 2015. ISBN: 978-3437267932.
- o Multimedia component: interactive 3D-learning platform of human anatomy and physiology BioDigital Human;
- o Online medical knowledge and information resources:
  - o Medscape
  - o WebMD
  - o Medline Plus
  - o eMedicine
  - o WikiDoc
  - o Google Scholar
  - o PubMed
  - o PubMed Health

#### **Computer Science for Medics:**

- o Edward K. Blum / Alfred V. Aho (2011), Computer Science: The Hardware, Software and Heart of It, Springer Science+Business Media New York.
- o Erich Gamma / Richard Helm / Ralph E. Johnson, John Vlissides (1994) Design Patterns. Elements of Reusable Object-Oriented Software, Prentice Hall.
- o Mary Poppendieck / Tom Poppendieck (2006) Implementing Lean Software Development – From Concept to Cash, Addison Wesley.
- o Jeff Sutherland / JJ Sutherland (2015), Scrum: The Art of Doing Twice the Work in Half the Time, Random House Business.
- o Donald G. Reinertsen (2009), The Principles of Product Development Flow: Second Generation Lean Product Development, Celeritas Publishing.
- o Robert C. Martin (2008), Clean Code: A Handbook of Agile Software Craftsmanship, Prentice Hall.
- o Klaus Hoermann / Markus Mueller / Lars Dittmann / Joerg Zimmer (2008), Automotive SPICE in Practice: Surviving Interpretation and Assessment, Rocky Nook Computing.

#### **▶ MI-01 FWP-1: MEDICINE FOR NON-PHYSICIANS**



### **Type of Examination**

written ex. 90 min.

### **▶ MI-01 FWP-2: COMPUTER SCIENCE FOR MEDICS**

### **Type of Examination**

written ex. 90 min.



## MI-02 INTERNATIONAL HEALTH CARE

Module code	MI-02
Module coordination	Prof. Dr. Georgi Chaltikyan
Modul-gruppe	Health Care
Course number and name	International Health Care Management
Lecturers	Prof. Dr. Georgi Chaltikyan Anna Schmaus-Klughammer
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

#### Learning Outcomes of the Module:

The students will learn all relevant issues concerning International Healthcare Management and International Healthcare Law. They will learn all relevant parts of management in healthcare organizations and health systems. They will understand that the future leaders of healthcare systems need to be able to integrate theory and practice and to have the adaptability and flexibility that comes from really understanding the nature of management and leadership. The students will learn different scenarios of healthcare insurance systems. They will simulate the outcome of changes in the structure of insurance systems.

Students will get an overview of the determinants of health and how health status is measured. Students will also review the burden of disease, who is most affected by different disease burdens, risk factors, and key measures to address the burden of disease. Special attention is paid throughout the module to health systems issues. The module includes an overview of the structure of healthcare systems in selected countries worldwide. The focus is on the developmental history of the national healthcare systems, financing, and delivery infrastructure.



Students will also learn how the law governs the delivery of healthcare in different countries. Students will understand that apart from law, ethical issues are important.

After completing the module International Healthcare the students will have achieved the following learning objectives:

Professional competences:

- o Understanding healthcare in a broader context;
- o Knowledge of key public health concepts, including: the demographic and epidemiological transitions, the burden of disease, the impact of key health conditions on individuals and on communities, and critical issues in the organization and delivery of health services;
- o Knowledge of the determinants of health and risk factors for conditions of importance to international health systems;
- o Knowledge of the most important components of healthcare delivery, of the structure and functioning of healthcare systems;
- o Knowledge of healthcare funding including transactions between providers who transfer resources to patients and transactions between patients or third parties who transfer resources to providers;
- o Knowledge of the main structural and operational characteristics of the healthcare systems in different high-, middle-, and low-income countries.
- o Knowledge of International Healthcare Law;
- o Knowledge of EU Healthcare Law;
- o Knowledge about the constitution of the World Health Organization (WHO);
- o Knowledge about Malpractice Litigation;
- o Knowledge about the WHO Framework Convention on Tobacco Control (FCTC).

Methodical expertise:

- o Discuss with confidence the burden of disease in various regions of the world, how it varies both within and across countries, and how the disease burden can be addressed in cost-effective ways;
- o Outline the key actors and organizations in health systems globally and in selected countries, and the manner in which they operate to address critical health issues;
- o Analyze key challenges that are likely to arise in the coming decades in addressing the health in different high-, middle-, and low-income countries;
- o Application of Healthcare Management methodology;



- o Application of Healthcare Law to practical cases;
- o Working with eHealth platforms for blended learning;

Personal competences:

- o Ability to analyze the structure and understand the meaning of commonly used healthcare management terms;
- o Ability to analyze the structure and understand the meaning of commonly used healthcare law terms;
- o Construct descriptions of structure and operation of the healthcare system in a particular country of interest;
- o Present a health issue in a particular country or area in the world, or a global health issue, in a comprehensive way.

Social competence:

- o Working in small groups discussing and presenting various healthcare management issues and challenges in different countries.

## **Applicability in other Programs**

The Module introduces the student to Healthcare Management with emphasis on international issues.

Can be used in other study programs related to healthcare.

## **Entrance Requirements**

none

## **Learning Content**

I. Global Health and the Burden of Disease:

1. Principles and Goals of Public and Global Health;
2. Health Determinants, Measurements and Trends;
3. Health, Education, Poverty and the Economy;
4. Environmental Health;
5. Nutrition and Global Health;
6. Women's Health;
7. Child and Adolescent Health;



8. Communicable Disease;
  9. Non-communicable Diseases;
  10. Unintentional Injuries
- II. Management of Health Systems and Organizations:
1. Management and Leadership in Healthcare;
  2. Healthcare Services: Primary Care, Acute and Chronic Care, Mental Health, Social Care;
  3. Funding Methods and Healthcare Costs;
  4. Allocating Resources for Healthcare;
  5. Purchasing and Contracting Healthcare;
  6. Capital in Healthcare Systems: Buildings, Facilities, Equipment;
  7. Healthcare Workforce;
  8. Patient and Public Involvement;
  9. Governance and Accountability in Healthcare;
  10. Performance and Quality Improvement.
- III. Review of International Health Systems:
1. Healthcare in Germany;
  2. Healthcare in USA;
  3. Healthcare in Canada;
  4. Healthcare in UK;
  5. Healthcare in France;
  6. Healthcare in Japan;
  7. Healthcare in Russia;
  8. Healthcare in India;
  9. Healthcare in Brazil;
  10. Healthcare in Select African countries.
- IV, Law and Ethics in Healthcare:
1. Introduction



2. EU Law
3. Safe Harbor
4. International Healthcare Law
5. International Healthcare Regulations and Declarations
6. Professional Regulations
7. Malpractice Litigation

## Teaching Methods

Lectures, seminar discussions, case studies, student presentations.

## Remarks

Guest lecture by an external expert (optional)

## Recommended Literature

- o Kieran Walshe and Judith Smith: Healthcare Management, 3<sup>rd</sup> Edition, Open University Press, McGraw-Hill Education, 2017;
- o Richard Skolnik: Global Health 101, 3rd edition, Jones & Bartlett Learning (JBL) 2016;
- o James A. Johnson, Carleen Stoskopf, Leiyu Shi: Comparative Health Systems: Global Perspectives, 2nd edition, JBL 2017.
- o Margie Lovett-Scott and Faith Prather: Global Health Systems: Comparing Strategies for Delivering Health Services, JBL 2014;
- o Jonathan Montgomery: Healthcare Law, 2<sup>nd</sup> Edition, Oxford University Press.

## ▶ INTERNATIONAL HEALTH CARE MANAGEMENT

### Type of Examination

written ex. 90 min.





## MI-03 MEDICAL INFORMATICS

Module code	MI-03
Module coordination	Prof. Dr. Horst Kunhardt
Modul-gruppe	eHealth
Course number and name	Case Study Medical Informatics Medical Informatics
Lecturers	Prof. Dr. Horst Kunhardt Christian Roth
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

Students should become aware of current technologies and concepts that are used to develop and manage computer systems in medical and health care environments. They become also aware about legal requirements and related assessment methods.

Students will be able to analyze data from SQL databases and other data sources. They will be able to develop software that automates data analysis and data transformation tasks. Furthermore they will be able to integrate current data mining and deep learning frameworks into their software.

Another important part targets the development of heterogeneous and distributed computer systems that are often part of today's medical environments. Students learn to integrate data from electronic sensors into their software and to control actuators by their software.

Students are presented with practical case studies. These case studies target the application of data analysis frameworks and tools as well as the hands-on development of software that integrates data analysis, deep learning and distributed computing frameworks.



Professional competence:

- o Knowledge about the development of software and IT systems in medical and health care environments.
- o Knowledge of the main concepts of data analysis, data mining and data processing. Students can explain differences between data mining methods and understand how to apply them. They are able to model and prepare data for data analysis processes and to execute data analysis processes. They are aware of the different stages of a data mining process.
- o Knowledge about the application of artificial intelligence methods like neural networks.
- o Understanding of the challenges of developing distributed computer systems. Students learn aspects of multi agent systems and how to handle the internal state of a distributed computer system. They are able to use current frameworks and protocols to program distributed computer systems. They understand how the integration of external computer systems and data sources influences the complexity of their software. They learn to handle concurrency within distributed computer systems.
- o Knowledge of database systems and database design. Students will be able to identify to create relational database designs that avoid data loss and data inconsistency. They are able to explain how a relational database stores data.
- o Understanding of IT System Management, IT Alignment and IT Governance and their implementation in a working organization.
- o Knowledge about software system architectures and their influence on the management, operation and maintenance of IT systems.

Methodical expertise:

- o Ability to implement computer programs that integrate data mining and deep learning frameworks as well as different data sources like SQL databases, files or sensors.
- o Ability to prepare data for the usage in data mining tools.
- o Ability to use data mining tools to analyze huge amount of data and create predictions.
- o Ability to create queries for relational databases. Students are able to read and write SQL queries.
- o Application of risk assessment methods.
- o Ability to detect risks in the application of computer systems in medical and health care environments.



Personal competence:

- o Ability to understand aspects, concepts and technologies that are often used in medical and health care environments.
- o Students learn to understand and verify data analysis results. They learn how artificial intelligence algorithms work and which problems can be solved with the application of artificial intelligence.
- o Students understand the importance of IT management and IT alignment to setup an effective and efficient organization.

Social competence:

- o Understanding of quality as key factor in every stage of the development process of medical computer systems. Students get aware of the situation that medical computer systems can harm humans and that failures in medical computer systems can lead to fatal consequences.

## Applicability in other Programs

Fundamental module for the study program especially for module Data Security and Data Protection.

Can be used in any other study program in the field of Health IT.

## Entrance Requirements

none

## Learning Content

1. Development aspects of medical computer systems
  - 1.1 Legal requirements
  - 1.2 Privacy
  - 1.3 Risk Assessment
  - 1.4 Electromagnetic compatibility
2. Development of heterogeneous and distributed computer systems
  - 2.2 Architecture of heterogeneous and distributed computer systems
  - 2.3 Medical system integration
  - 2.4 Message-driven applications and the actor model
  - 2.5 Communication with electronic sensors and actuators



- 2.6 Frameworks and communication protocols
- 2.7 Programming of heterogeneous and distributed software
- 2.8 Aspects of multi agent systems
- 2.9 Integration of legacy systems
- 3. Data analysis
  - 3.1 Modeling of SQL databases
  - 3.2 Analysis of data from SQL databases
  - 3.3 Big data processing and transformation
  - 3.4 Data mining processes (CRISP-DM)
  - 3.5 Data mining methods (Classification, Clustering, Market Basket)
  - 3.6 Application of data mining software
- 4 Artificial Intelligence
  - 4.1 Foundations of Neural Networks
  - 4.2 Image recognition systems
  - 4.3 Application in medical and health care environments
- 4. Development of data processing software systems
  - 4.1 Architecture of data processing software
  - 4.2 Artificial Intelligence and deep learning frameworks
  - 4.3 Programming of data processing software
  - 4.4 Integration of electronic data sources and targets
- 5. IT Management
  - 5.1 IT Security Management
  - 5.1 Management of Information Systems
  - 5.2 IT Governance and IT Alignment
  - 5.3 Requirements Management and Requirements Engineering
  - 5.4 Agile IT Management
  - 5.5 Aspects of Micro Service architecture



## 5.6 Application Lifecycle Management

### Teaching Methods

Lectures, exercises, case study;

### Recommended Literature

- o Edward K. Blum / Alfred V. Aho (2011), Computer Science: The Hardware, Software and Heart of It, Springer Science+Business Media New York.
- o Erich Gamma / Richard Helm / Ralph E. Johnson, John Vlissides (1994) Design Patterns. Elements of Reusable Object-Oriented Software, Prentice Hall.
- o Johannes Ledolter (2013), Data Mining and Business Analytics with R, Wiley
- o Ian H. Witten / Eibe Frank / Mark A. Hall (2011), Data Mining – Practical Machine Learning Tools and Techniques, Morgan Kaufmann
- o Gerhard Weiss (1999), Multiagent Systems – A Modern Approach to Distributed Artificial Intelligence, MIT Press
- o Drew Conway, John Myles White (2012), Machine Learning for Hackers, O'Reilly Media
- o Philipp K. Janert (2010), Data Analysis with Open Source Tools, O'Reilly Media

### ▶ CASE STUDY MEDICAL INFORMATICS

#### Type of Examination

part of module exam, written ex. 90 min.

### ▶ MEDICAL INFORMATICS

#### Type of Examination

part of module exam, written ex. 90 min.



## MI-04 EHEALTH AND TELEMEDICINE

Module code	MI-04
Module coordination	Prof. Dr. Georgi Chaltikyan
Modul-gruppe	eHealth
Course number and name	MI-04 Case Study Telemedicine MI-04 eHealth and Telemedicine
Lecturers	Prof. Dr. Georgi Chaltikyan Anna Schmaus-Klughammer
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

eHealth and telemedicine are the major practical domains of Medical Informatics, addressing application of modern Information and Communication Technologies in medical practice, as well as in healthcare administration, management, and regulation. Telemedicine is a rapidly evolving field as new technologies are implemented. Using the Internet applications such as counseling, clinical consultation support and home care monitoring and management are more and more realized, which improves access to high level medical care in underserved areas.

In Low- and Middle Income Countries (LMICs) telemedicine enables physicians to collaborate with their peers from other countries. Individual clinicians in remote areas are able to exchange diagnoses and opinions with expert doctors. They feel part of their profession and of an international group of colleagues. Continuing Medical Education (CME) via telemedicine in remote areas improves local care and overcomes professional isolation of healthcare personnel.

Knowledge of current eHealth practices and available telemedicine services, together with eHealth and telemedicine project and program development and implementation skills, are important for building competence in Medical Informatics.



After completing the module the students achieved following learning targets:

Professional competence:

- o Knowledge of the main concepts, types, applications and services of eHealth and telemedicine in various medical specialties;
- o Knowledge of the current state of eHealth and telemedicine in different regions and countries of the world;
- o Familiarity with the underlying technology in eHealth and telemedicine;
- o Knowledge of logistical and organizational aspects of eHealth and telemedicine;
- o Understanding of the benefits, opportunities, challenges and barriers to implementation of eHealth and telemedicine;
- o Knowledge of inherent ethical, legal, and financial issues in eHealth and telemedicine, and of relevant legal frameworks in different countries;
- o Knowledge of the difference of eHealth and telemedicine applications in High Income Countries (HICs) and Low and Middle Income Countries (LMICs).

Methodological expertise:

- o Application of the principles of setup, operation and maintenance of telemedicine sites and networks;
- o Ability to design eHealth and telemedicine projects for different scenarios;
- o Ability to work with typical telemedicine software e.g. case.io and Campus Medicus, and with telemedicine devices and applications;
- o Ability to build up an e-learning lecture.

Personal competence:

- o Ability to perform and present SWOT analysis of eHealth and telemedicine projects and programs;
- o Ability to reflect on different ethical, legal, and financial issues in eHealth and telemedicine, and to analyze relevant legal frameworks in different countries;
- o Critical discussion of the available evidence of effectiveness, including cost-effectiveness, of eHealth and telemedicine.

Social competence:

- o Interdisciplinary and interpersonal collaboration when working together in small groups on developing sample eHealth and telemedicine projects.



## Applicability in other Programs

The module introduces the student to the foundations and main features of eHealth and telemedicine. It is interrelated with the module 7-eHealth Application Systems.

Can be used in other study programs in the field of Applied Health Sciences, such as IT in Healthcare.

## Entrance Requirements

none

## Learning Content

1. Overview of eHealth and Telemedicine: definitions and terminology; history of eHealth and telemedicine; telemedicine setup, types, and services; recent trends in eHealth and telemedicine; eHealth tools and services; rationale, benefits and opportunities, challenges and barriers of eHealth and telemedicine; facts and figures about eHealth and telemedicine; main players, projects and programs; the future developments.
2. Technological Aspects of eHealth and Telemedicine: requirements for technology; healthcare data and information; telecommunication basics; wired and wireless telecommunication; Internet and computer networks; videoconferencing equipment; special telemedicine devices; telemedicine software; telemedicine site setup.
3. Organizational Aspects of eHealth and Telemedicine: eHealth and telemedicine project and program management (needs assessment, planning and development, implementation and monitoring, evaluation and reporting); factors of success and failure; eHealth and telemedicine good practices.
4. Clinical eHealth and Telemedicine Services: features of real-time (synchronous) telemedicine; features of store-and-forward (asynchronous) telemedicine; general teleconsultations; specialty telemedicine: teleradiology, telepathology, teledermatology, telecardiology and ECG; tele-neurology and tele-stroke; teleophthalmology and tele-ENT; acute care and emergency telemedicine; tele-psychiatry; telesurgery.
5. Ethical, Legal and Economic Aspects of eHealth and Telemedicine: patient-physician relationship as applies for telemedicine; informed consent; confidentiality and privacy; quality of care; standards – adequacy and quality of data; continuum of care; data security; liability; licensure; record keeping; guidelines and protocols; telemedicine legislation; reimbursement policies and practices.





6. Evidence in eHealth and Telemedicine: effectiveness and cost-effectiveness of various eHealth and telemedicine technologies; current and future research on eHealth and telemedicine.

## Teaching Methods

Combination of lectures, seminars, presentations, and a practical/project part

## Remarks

- o Working with telemedicine platforms case.io and Campus Medicus;
- o Hands-on training with telemedicine and eHealth devices and applications;
- o Guest lecture by an external telemedicine expert (optional);
- o Visiting a user of a telemedicine platform in Germany;
- o Online discussion with a user of a telemedicine platform in LMICs.

## Recommended Literature

- o Fong B., Fong A.C.M., Li C.K. (2011): Telemedicine Technologies: Information Technologies in Medicine and Telehealth. Wiley, Chichester (UK).
- o Wootton R., Craig J., Patterson V. (2006): Introduction to Telemedicine. CRC Press, Boca Raton/London/New York.
- o Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.
- o Wootton R., Patil N.G., Scott R.E., Ho K. (2009): Telehealth in the Developing World. Royal Society of Medicine Press, London/Glasgow.
- o Grasczew G. and Rakowsky S. (2011): Telemedicine Techniques and Applications. InTech.

### ▶ MI-04 CASE STUDY TELEMEDICINE

#### Type of Examination

part of module exam

### ▶ MI-04 EHEALTH AND TELEMEDICINE

#### Type of Examination

part of module exam



## MI-05 STANDARDS, TERMINOLOGY AND CLASSIFICATION

Module code	MI-05
Module coordination	Prof. Dr. Georgi Chaltikyan
Modul-gruppe	eHealth
Course number and name	Case Study Standards, Terminology and Classification in Medicine Standards, Terminology and Classification in Medicine
Lecturer	Prof. Dr. Georgi Chaltikyan
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

Medicine and healthcare are extremely data-, information-, and knowledge-rich domains, which use hundreds of thousands of terms, concepts, definitions, descriptions, and their interrelationships in vocabularies, nomenclatures, and classification systems. Proper functioning of healthcare systems critically depends on the ability to process information in a meaningful way, which necessitates development of terminology sets and classification systems. In Health IT era universally accepted data standards are especially crucial for exchange of health information between care settings, regions and countries, and globally.

The overall aim of this module is to introduce the students to the principles of information representation in healthcare, and to familiarize them with important healthcare data coding standards, terminologies, and classification systems.

After completing the module the students achieved following learning targets:

Professional competence:



- o Understanding of the characteristics of medical language;
- o Knowledge of common biological and medical terms and principles of their composition;
- o Understanding of the main instruments in healthcare data representation (terminology, vocabulary and nomenclature, classification and taxonomy, ontology, thesaurus), and of the differences between them;
- o Understanding of the requirements for standardization and formalization of medical language, and the main principles of developing and maintaining controlled medical vocabularies;
- o Knowledge of the most common terminologies, classifications, and coding systems used in medicine and healthcare: ICD and other WHO Classifications, SNOMED-CT, DRG, CPT and OPS codes, LOINC, Medical Subject Headings (MeSH), and UMLS, among others;
- o Knowledge of the various uses of terminology and classifications systems.

Methodical expertise:

- o Application of various medical coding techniques in different healthcare institution settings;
- o Working with major terminology servers;
- o Working with dedicated terminology resources in the healthcare domain;
- o Retrieving terms and concepts or codes related to various organs and systems.

Personal competence:

- o Ability to analyze the structure and understand the meaning of commonly used medical terms;
- o Ability to describe and critically discuss the standards, terminologies, and classification systems used in various healthcare settings and countries.

Social competence:

- o Working in groups on small projects.

## **Applicability in other Programs**

This module is closely interrelated with the module 7 – Medical Documentation Systems.

Can be used in any other study program in the field of Health IT.

## **Entrance Requirements**



none

## Learning Content

1. Overview of Medical Terminology: Need for standards and interoperability; syntax and semantics; definitions of terminology, vocabulary, nomenclature, classification, taxonomy, thesaurus, ontology; the biological and medical language; origin and structure of medical terms; most common roots, suffixes and prefixes; properties of medical language; medical terminology describing the human body; terminology of organ systems and their diseases.
2. Standardizing Healthcare Data: healthcare terminology standards; differences between terminology and classification; problems in standardizing terminologies; requirements for standardizes terminologies; desiderata for controlled terminologies; completeness of a terminology system; types of standardized terminology systems; existing terminology and classification systems.
3. International Statistical Classification of Diseases and Related Health Problems (ICD): description, purposes ad uses of ICD, WHO Family of International Classifications; history and evolution of ICD; general information on ICD-10; composition of ICD-10; coding in ICD-10; the future – ICD-11; ICD-10-GM; the ICD modifications in the US: ICD-9-CM vs. ICD-10-CM.
4. SNOMED: history and evolution of SNOMED; structure of SNOMED; limitations of SNOMED; SNOMED RT; general information on SNOMED CT; composition of SNOMED CT; uses of SNOMED CT; limitations of SNOMED CT; resources on SNOMED CT.
5. DRG, CPT and OPS: general information and uses of DRG; history and evolution; structure and development of DRG; German G-DRG System: evolution, structure, usage; US CPT coding system; Healthcare Common Procedure Coding System (HCPCS); German OPS coding system.
6. LOINC, GALEN, MEDCIN, RxNorm: general information on LOINC; structure of LOINC; LOINC names, scope, development; RELMA; LOINC resources; GALEN; MEDCIN; RxNorm
7. ICF and ICHI: introduction and general concept of ICF; application of ICF; Structure of ICF; strengths and limitations of ICF; general information on ICHI; history and current state of ICHI.
8. UMLS and MeSH: general information on UMLS; purpose and uses of UMLS; structure of UMLS; UMLS Metathesaurus; UMLS Semantic Network; UMLS SPECIALIST Lexicon; UMLS services and tools; limitations of UMLS; general information on MeSH; structure and uses of MeSH; UMLS and MeSH Resources.
9. Aligning and Mapping of Healthcare Code Sets, Terminologies and Classification Systems: discovering common ground between different sets and systems; purpose of data maps; typical content and structure of maps; principles and



process of map development; map validation and maintenance; example: mapping SNOMED-CT to ICD-10.

- 10. Usage of Vocabulary, Terminology and Classification Systems: EHR applications; administrative applications; interoperability issues; implementation issues (standard selection; data mapping; subsets, value sets and reference sets, terminology binding and the information model).

## Teaching Methods

Combination of lectures, presentations and practical exercises.

## Remarks

- o Working with terminology servers;
- o Guest lecture by an external expert (optional);
- o Online introductory course on SNOMED CT by the IHTSDO (optional)

## Recommended Literature

- o Giannangelo K. (2015): Healthcare Code Sets, Clinical Terminologies, and Classification Systems. AHIMA Press, Chicago.
- o Chabner D.-E. (2015): Medical Terminology: A Short Course. 6<sup>th</sup> Edition. Elsevier Saunders, Maryland Heights.
- o Hoyt R.E., Yoshihashi A. (2014): Health Informatics: Practical Guide for Healthcare and Information Technology Professionals. 6<sup>th</sup> Edition. Lulu.
- o Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.
- o SNOMED CT Starter Guide, downloadable at [www.snomed.org/starterguide.pdf](http://www.snomed.org/starterguide.pdf)

### ▶ CASE STUDY STANDARDS, TERMINOLOGY AND CLASSIFICATION IN MEDICINE

#### Type of Examination

part of module exam

### ▶ STANDARDS, TERMINOLOGY AND CLASSIFICATION IN MEDICINE

#### Type of Examination



part of module exam



## MI-06 EVIDENCE-BASED MEDICINE

Module code	MI-06
Module coordination	Prof. Dr. Georgi Chaltikyan
Modul-gruppe	Research & Methodology
Course number and name	Case Study Evidence-based Medicine Evidence-based Medicine
Lecturer	Prof. Dr. Georgi Chaltikyan
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	7
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

Modern practice of medicine heavily relies on the evidence obtained through high quality research on etiology and pathogenesis, diagnosis and treatment of diseases and conditions. The concept of Evidence-Based Medicine (EBM) introduced in 1980s provides foundation for scientifically proven practice of medicine, and implies incorporation of the best available evidence, together with the clinician's knowledge and expertise, and patient's expectations, into the process of medical decision-making. EBM knowledge and skills are critical for medical informatics specialists in understanding and managing medical and healthcare decision support.

The overall aim of this module is to introduce the students to the principles and practices of EBM, and to familiarize them with the methods used to generate, retrieve, assess and report clinical research data.

After completing the module the students achieved following learning targets:

Professional competence:

- o Knowledge of the concept, goals and principles of Evidence-Based Medicine, definitions, historical highlights, recent advances and potential future developments, strengths and weaknesses of EBM;



- o Knowledge of the important steps in the process of practicing EBM;
- o Knowledge of the types of clinical studies and of the levels of evidence;
- o Knowledge of the sources of medical scientific literature and of the most important EBM resources;
- o Understanding of the main principles of critical appraisal of the results of clinical studies;
- o Knowledge of the main features and the process of development and implementation of clinical practice guidelines;
- o Understanding of the role of medical informatics in supporting EBM.

Methodical expertise:

- o Formulation of a clinical question in PICO format;
- o Application of various methods of retrieval of medical scientific literature, search strategies and techniques;
- o Application of methods of critical appraisal of medical research papers (validity, results and applicability);
- o Usage of statistical assessment tools (formulas and online calculators).

Personal competence:

- o Realistic assessment of the strengths, abilities and limitations of different types of research evidence in the decision making process;
- o Ability to critically discuss advantages and disadvantages of different study designs;
- o Ability to analyze and discuss the ethical aspects of medical research.

Social competence:

- o Interdisciplinary and interpersonal collaboration when working together in small groups on retrieving and analyzing evidence on particular clinical or public health question.

## **Applicability in other Programs**

This module is closely interrelated with the module 9 - Health Economy and Health Research.

Can be used in other study programs in Applied Health Sciences (e.g. IT in Healthcare).





## Entrance Requirements

Basic knowledge of biomedical sciences.

## Learning Content

1. Basics of Evidence Based Medicine: introduction, definitions, history of Evidence Based Medicine; concept; recent developments; importance of EBM in medical practice, education, research and administration; the process and steps in EBM.
2. Formulating Medical Decision Query: major steps in EBM; formulating a question; background vs. foreground questions; PICO question algorithm; PICO variations; types of clinical questions/studies (diagnosis, therapy, prognosis, harm/etiology, economic); importance of formulating a query.
3. Online Medical Information Resources and Information Retrieval: the process of finding the evidence; medical knowledge resources; medical textbooks online; scientific medical journals; MEDLINE; evidence review resources; drug databases; diseases databases; composite resources; search engines and search strategies.
4. Critical Appraisal of Evidence: the evidence pyramid; types of study design: number of one study, case-control studies, cohort studies, randomized controlled studies, crossover studies, systematic reviews and meta-analyses, other study designs; validity of evidence; reliability of evidence; relevance (applicability) of evidence; levels of evidence; statistical tools and measures;
5. Results Assessment – diagnosis studies: Incidence and Prevalence, Sensitivity, Specificity, Positive and Negative Predictive Value, Likelihood Ratio, Pretest and Posttest Probability and Odds;
6. Results Assessment – therapy studies: Relative Risk and Relative Risk Reduction, Absolute Risk Reduction, Number Needed to Treat/Harm, Odds Ratio; Statistical Significance and p Value; Precision Values (Confidence Interval);
7. Applicability Assessment: therapy studies, diagnosis studies; appraisal of systematic reviews; appraisal of qualitative research; appraisal of clinical decision analyses; appraisal of economic analyses; appraisal of prognosis studies; appraisal of harm/etiology studies.
8. Application and Evaluation of Evidence. Criticism and Limitations of EBM.
9. Clinical Practice Guidelines (CPGs): developing CPGs; strength of recommendation; individual application of CPGs; quality of guidelines; barriers to implementation of Clinical Practice Guidelines; CPG strategies; electronic CPGs; CPG resources.
10. Evidence-Based Medical Informatics.

## Teaching Methods



Combination of lectures, seminars, practical exercises and students presentations.

## Remarks

Guest lecture and demonstration of decision support system UpToDate ® (optional).

## Recommended Literature

- o Prasad K. (2013): Fundamentals of Evidence Based Medicine. Springer India, Heidelberg / New York / Dordrecht / London.
- o Straus S.E., Howerton L.J., Richardson W.S., Haynes R.B. (2010): Evidence-Based Medicine: How to Practice and Teach It. Elsevier, Oxford/ Edinburgh.
- o Jacobsen K. (2017): Introduction to Health Research Methods: A Practical Guide. JBL, Burlington, MA.
- o Greenhalgh T. (2014): How to Read a Paper: The Basics of Evidence-Based Medicine. John Wiley & Sons, Chichester, West Sussex, UK.
- o Sox H.C., Higgins M.C., & Owens D.K. (2013): Medical Decision Making. John Wiley & Sons, Chichester, West Sussex, UK.
- o Hunink M.G.M., Weinstein M.C., Wittenberg E., Drummond M.F., Pliskin J.S., Wong J. B., & Glasziou P. P. (2014): Decision Making in Health and Medicine: Integrating Evidence and Values. Cambridge University Press, Cambridge.
- o Hoyt R.E., Yoshihashi A. (2014): Health Informatics: Practical Guide for Healthcare and Information Technology Professionals. 6<sup>th</sup> Edition. Lulu.
- o Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.

### ▶ CASE STUDY EVIDENCE-BASED MEDICINE

#### Type of Examination

part of module exam

### ▶ EVIDENCE-BASED MEDICINE

#### Type of Examination

part of module exam



## MI-07 MEDICAL DOCUMENTATION SYSTEMS

Module code	MI-07
Module coordination	Prof. Dr. Georgi Chaltikyan
Course number and name	Case Study Hospital Information System Medical Documentation Systems
Lecturers	Prof. Dr. Georgi Chaltikyan Stefan Kahlert
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	6
ECTS	7
Workload	Time of attendance: 70 hours self-study: 140 hours Total: 210 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

Maintaining patient records is among the core workflow processes in healthcare delivery. With introduction and development of Health Information Technologies healthcare systems around the world are transitioning from traditional paper-based medical records to computer-based records and care management systems. Comprehensive, secure and interoperable Electronic Health Record (EHR) is the central functional component of a digital Hospital Information System (HIS) and is critical for enhancing quality and efficiency of healthcare delivery, while Health Information Exchange (HIE) provides frameworks for electronic movement of records between care settings, providers, regions and countries, thus supporting continuity of care.

The overall aim of this module is to introduce the students to the main features and processes in the domain of medical documentation, and to modern digital solutions for healthcare workflow management.

After completing the module the students achieved following learning targets:

Professional competence:

- o Knowledge of the main principles and parts of medical documentation;



- o Knowledge of the structure and function of an Electronic Health Record and its main components;
- o Understanding of the approaches to EHR interoperability and general knowledge of the HL7 standard;
- o Knowledge of the main components and functions of the Clinical Information Systems;
- o Understanding of the main principles of Health Information Exchange;
- o Understanding of the role of EHR in public health and medical research.

Methodological expertise:

- o The students can build or modify simple EHR using open source or simulation systems;
- o The students can compile simple projects on development of a Hospital Information System or a Practice Management System.

Personal competence:

- o Ability to critically discuss the advantages and disadvantages of EHR, and to reflect on critical issues on EHR deployment and implementation, such as the impact of usability on EHR adoption;
- o Ability to reflect on the role of EHR in improving patient safety;
- o Ability to analyze and discuss the role and potential of EHR in clinical, population and public health.

Social competence:

- o Group work on sample Electronic Health Records and Hospital Information Systems.

## **Applicability in other Programs**

This module is fundamental to the most Medical Informatics competences; it is closely interrelated with the module 5 - Standards, Terminology and Classification in Medicine.

This module can be used in other study programs in the field of Applied Health Sciences, such as Health Informatics.

## **Entrance Requirements**

Basic knowledge in biomedical sciences; knowledge of healthcare management and healthcare terminology standards.



## Learning Content

1. Principles of Medical Documentation: major components of a patient record; administrative component; demographics; clinical documentation component: chief complaint, history and medication list, physical examination, assessment and problem list; diagnoses; order entry; laboratory and instrumental tests; care plan; progress notes; discharge summaries.
2. Electronic Health Records (EHR): overview, rationale, need, benefits (added value) and challenges of EHR; EHR examples; accreditation and certification; regulatory aspects; EHR types; adoption of EHR in different areas and countries; US HITECH initiative and Meaningful Use incentives.
3. Structure and Function of the Comprehensive Electronic Health Record: source vs. problem oriented records; healthcare data structure and elements; EHR key components; Computerized Physician Order Entry (CPOE); Clinical Decision Support Systems (CDSS); Electronic Prescribing (e-prescription).
4. Interoperability of Health Records: importance of interoperability; overview of current interoperability standards; XML standard; HL7: history and evolution, current state, management and evolution, structure, Clinical Document Architecture (CDA), Continuity of Care Document (CCD); emerging standards (FHIR).
5. Hospital Information Systems: history; main processes and factors; business processes; computerization strategies; structure- and process-oriented approaches; major components of HIS; HIS project management and evaluation.
6. Computerization of Practice Management: information systems of primary care physicians and specialists; main components and functions of Practice Management Software; technological aspects; outcomes and incentives initiatives (Meaningful Use).
7. Health Information Exchange (HIE): challenges of sharing healthcare data; technical aspects of HIE; legal and ethical aspects of HIE; privacy and security; semantic interoperability; national and international HIE initiatives in Europe and North America.
8. EHR and Patient Safety: patient safety reports; organizations and programs supporting patient safety; health information technology and patient safety; technologies to decrease medication errors; barriers to improving patient safety through EHR implementation; future trends.
9. The Role of EHR in Public Health and Public Health Informatics: public health surveillance; the Public Health Information Network (PHIN); Geographic Information Systems (GIS); public health data tools and statistics; global Public Health informatics.



10. Secondary Use of Medical Documentation: Translational Bioinformatics and information systems for biomedical research; Clinical Research Informatics and information systems for clinical research; Clinical Data Warehouses (CDWs) and data mining; challenges; projects and programs in research informatics.

## Teaching Methods

Combination of lectures, seminars, practical work and student´s presentations.

## Remarks

- o Working with an open source EHR an HIS system installed on the Campus
- o Guest lectures by experts in the field
- o Field visits to hospitals and evaluation of HIS

## Recommended Literature

- o Nelson R., Staggars N. (2018): Health Informatics: An Inter-professional Approach. Elsevier, St. Louis, USA.
- o Hoyt R.E., Yoshihashi A. (2014): Health Informatics: Practical Guide for Healthcare and Information Technology Professionals. 6<sup>th</sup> Edition. Lulu.
- o Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.
- o Braunstein Mark L. (2015): Practitioner´s Guide to Health Informatics. Springer, Switzerland.
- o Fenton S.H., Biedermann S. (2014): Introduction to Healthcare Informatics. AHIMA Press, Chicago.
- o Braunstein Mark L. (2014): Contemporary Health Informatics. AHIMA Press, Chicago.
- o Open Source Clinical Documentation System: [www.mycare2x.org](http://www.mycare2x.org) [www.open-emr.org](http://www.open-emr.org)
- o Commercial Test Systems OpenMed and ORBIS by AGFA Health Care GmbH.

## ▶ CASE STUDY HOSPITAL INFORMATION SYSTEM

### Type of Examination

part of module exam

## ▶ MEDICAL DOCUMENTATION SYSTEMS



## Type of Examination

part of module exam



## MI-08 EHEALTH APPLICATION SYSTEMS

Module code	MI-08
Module coordination	Prof. Dr. Georgi Chaltikyan
Course number and name	Case Study eHealth Application eHealth Application Systems
Lecturer	Prof. Dr. Georgi Chaltikyan
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

From mobile health and fitness apps to wearables and nanosensors, and from virtual reality to personalized medicine, various eHealth applications are disrupting traditional models of healthcare delivery, empowering patients and consumers, and introducing unprecedented change into the global healthcare landscape. The major driving forces behind the current explosive growth of mobile and consumer eHealth applications are technological advances and developments, and people's expectations of a better control of their health and disease.

The module addresses various application systems of eHealth across different specialties and care settings, such as wearable sensors and monitoring devices, medical imaging techniques, mobile health and distant monitoring systems, home telehealth, surgical robotics and others, and also focuses on consumer eHealth applications, presenting and discussing the near future trends such as personalized medicine.

After completing the module the students achieved following learning targets:

*Professional competence:*

- o Knowledge of the main technological solutions used to obtain patient data;





- o Knowledge of the medical imaging formats and processing and understanding of PACS architecture and workflow;
- o Knowledge of the main developments and trends in the field of mobile health and remote patient monitoring;
- o Familiarity with the most common health and fitness apps;
- o Knowledge of the different types and technology used in remote monitoring in health and disease;
- o Understanding of the usage of eHealth technologies in medical and surgical interventions;
- o Familiarity with common consumer eHealth applications and personal health record services;
- o Understanding of the legal requirements and regulation processes of eHealth technologies.

Methodical expertise:

- o Ability to work with medical images using a DICOM viewer;
- o Ability to design a simple remote monitoring project for a health provider using available information about existing commercial products;
- o Ability to create a requirements and specifications set for a direct-to-consumer eHealth platform or a personal health record.

Personal competence:

- o Analysis of the factors of success and failure of various eHealth projects, applications and services;
- o Critical discussion of the current challenges and opportunities in mobile and wireless eHealth applications.

Social competence:

- o Working together with fellow-students in small groups on designing and developing sample eHealth applications.

## **Applicability in other Programs**

This module is interrelated with the module 3 - eHealth and Telemedicine.

This module can be used in other study programs in the field of Applied Health Sciences such as Health Informatics.

## **Entrance Requirements**



none

## Learning Content

### 1. Mobile eHealth Applications:

- 1.1. Evolution of mobile technology in medicine and healthcare;
- 1.2. Common mHealth applications and services;
- 1.3. Benefits and limitations of mHealth; business cases and stakeholders;
- 1.4. Regulatory, legislation and security aspects of mHealth;
- 1.5. Current trends and possible future developments;
- 1.6. Case studies of mHealth applications.

### 2. Wireless Monitoring for Health and Disease:

- 2.1. Concepts and definitions;
- 2.2. Distant patient monitoring;
- 2.3. Rationale for and benefits of remote patient care;
- 2.4. Telecare, Ambient Assisted Living (AAL) and other "smart home" and independent living techniques;
- 2.5. Future perspectives: advances in wearables and sensors;
- 2.6. Case studies of distant monitoring devices and software.

### 3. Consumer eHealth Applications:

- 3.1. Direct to consumer telemedicine, eHealth and mHealth solutions;
- 3.2. Personal Health Records (PHR), origin, history and examples, success and failure stories, barriers and opportunities;
- 3.3. Electronic patient to physician communication;
- 3.4. Patient web portals;
- 3.5. Future trends: Personalized and Precision Medicine;
- 3.6. Case studies of various consumer eHealth applications.

### 4. Medical Imaging Informatics:

- 4.1. Types of medical imaging technologies;
- 4.2. Digital image acquisition, storage and communication;



4.3. Compression standards and DICOM; image processing;

4.4. Picture Archiving and Communication Systems (PACS);

4.5. PACS architecture, functionalities and workflow;

4.6. Legacy PACS versus web-based and mobile PACS;

4.7. Case studies of medical imaging informatics.

#### **5. Enhanced Medical Intervention and Robotics:**

5.1. Evolution of intervention techniques and approaches;

5.2. Technological solutions improving the quality of therapeutic intervention;

5.3. Visualization technique, surgical navigation, virtual reality;

5.4. Robotic assistance systems;

5.5. Innovation and the future of enhanced medical intervention;

5.6. Case studies of medical robotic systems.

#### **6. Technologies for Distant Medical Education:**

6.1. History and development of Internet-based learning;

6.2. Internet based educational software;

6.3. Future of Internet for Continuous Medical Education;

6.4. Case studies of web-based medical education and research.

#### **7. Legal and Regulatory Aspects of eHealth Applications:**

7.1. Regulation and certification of medical technologies and devices;

7.2. Legal frameworks and standards in the European Union;

7.3. Technology assessment, selection and procurement;

7.4. Case studies of legal and regulatory aspects of eHealth applications.

#### **8. Project eHealth Application:**

8.1. Design and development of various eHealth applications.

### **Teaching Methods**

Combination of lectures, seminars, presentation and a practical/project part.

### **Remarks**



- o Working with a DICOM viewer software
- o Working with mobile health devices and applications
- o Guest lecture by external experts (optional)

## Recommended Literature

- o Fong B., Fong A.C.M., Li C.K. (2011): Telemedicine Technologies: Information Technologies in Medicine and Telehealth. Wiley, Chichester (UK).
- o Venot A., Burgun A., Quantin C. (2014): Medical Informatics, e-Health. Springer, Paris/Heidelberg.
- o Hoyt R.E., Yoshihashi A. (2014): Health Informatics: Practical Guide for Healthcare and Information Technology Professionals. 6<sup>th</sup> Edition. Lulu.
- o Marston H.R., Freeman S., Musselwhite C. (2017): Mobile e-Health. Springer, Cham.
- o Adibi S. (2015): Mobile Health: A Technology Road Map. Springer, Cham.
- o Topol E. (2012): The Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care. Basic Books, New York.

## ▶ CASE STUDY EHEALTH APPLICATION

### Type of Examination

part of module exam

## ▶ EHEALTH APPLICATION SYSTEMS

### Type of Examination

part of module exam



## MI-09 HEALTH ECONOMY AND HEALTH RESEARCH

Module code	MI-09
Module coordination	Prof. Dr. Vaclav Hofman
Course number and name	Health Economy Medical Statistics and Data Analysis
Lecturers	Prof. Dr. Vaclav Hofman Prof. Dr. Agnes Nocon
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	6
ECTS	7
Workload	Time of attendance: 90 hours self-study: 120 hours Total: 210 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

After completing the module the students achieved following learning targets:

Professional competence:

- o Learning the basic principles of health economics and evaluation and classification into direct, indirect and intangible costs;
- o Evaluation of different approaches to the production, funding and distribution of health care using health economics and econometrics techniques;
- o Clear understanding of the importance of health and health care for the successful functioning of the economy;
- o Knowledge of descriptive approaches of analysis;
- o Understanding and application of the different methods of inferential analysis;
- o Understanding of the peculiarities of multifactorial experimental designs;
- o Knowledge of various types of experimental designs;



- o Understanding and application of various methodological frameworks: measurement theory, logic of logic of significance testing; design of experiments;
- o Comprehension of the consequences and differences of quasi-experimental, experimental and correlational research approaches;
- o Analysis and evaluation of research studies;
- o Evaluation of experimental biases and artefacts (e.g. experimenter effects, subjects effects).

Methodical expertise:

- o Using various methods such as cost-benefit analysis and cost-effectiveness analysis;
- o Application of various types of statistical analysis (descriptive and inferential);
- o Application of methods in various small projects;
- o Method selection according to different research requirements.

Personal and social competence:

- o Students are able to address the ethical and moral issues of health care programs and critically discuss the issues and challenges;
- o Cooperation in working on small group projects;
- o Realistic assessment of (general) individual strengths and weaknesses.

## **Applicability in other Programs**

Delivers statistical and methodological foundation for generating and interpreting research related knowledge in different areas of expertise.

Methodological foundation for any kind of empirical research, e.g. master thesis.

## **Entrance Requirements**

Basic knowledge of MS Excel highly recommended.

## **Learning Content**

### **A) Health economy**

Introduction to health economics

- o Health care as an economic goods
- o Health and health care



- o Wants, demands and needs

The demand for health insurance.

- o Demand choice theory
- o Consumer choice theory
- o Demand functions
- o The determinants of demand
- o Price and income elasticity of demand
- o Understanding investment in health care

The supply of health services.

- o Firms, markets, and industries in health care sector of the economy
- o Profit maximization models
- o Structure, conduct, and performance in the health care industry.

Markets, market failure, and the role of government in health care

- o Introduction
- o Using perfectly competitive markets to allocate resources
- o The efficiency of competitive markets
- o Market failure in health care
- o Government intervention in health care

Health insurance and health care financing.

- o Uncertainty in health care
- o Attitudes to risks
- o The demand for health insurance
- o Health insurance market failure
- o Options for health care financing
- o The key features of health care systems

Economic evaluation in health care.

- o What is economic evaluation?



- o Principles of economic evaluation in health care
- o Cost-benefit analysis
- o Cost-effectiveness analysis
- o Economic evaluation applied to health care programs
- o Decision analysis

#### Economic evaluation methods

- o Introduction
- o Selecting the viewpoints
- o Estimating costs
- o The measurement of health gain
- o Discounting
- o Modeling-based economic evaluation.

#### **B) Health Statistics**

- o Basics of measurement theory: scale levels nominal, ordinal, interval; operationalization;
- o Experimental design: dependent variable, independent variable; confounding variables; biases;
- o Descriptive statistics: measures of central tendency and dispersion; normal distribution; z-values, t-values; confidence intervals;
- o Inferential statistics: hypothesis testing; type 1/type 2 error; significance vs. meaningfulness; effect size;
- o Analyzing differences: t-test; ANOVA;
- o Analyzing relations: Chi<sup>2</sup>-test; correlation; regression;
- o Handling multiple factors: two-way, multi-factorial ANOVA;
- o Handling multiple predictors: multiple regression;
- o Exploratory approaches: cluster analysis, factor analysis, MDS;
- o Experimental vs. correlational research;
- o Methodological biases (e.g. experimenter effects);
- o Analyzing and evaluating other research.





## Teaching Methods

Combination of lecture, seminar, presentations and practical/project parts

## Recommended Literature

### Health economy

- o Morris, S., Devlin, N., & Parkin, D. (2007). Economic analysis in health care. John Wiley & Sons.
- o Gray, A. M., Clarke, P. M., Wolstenholme, J. L., & Wordsworth, S. (2010). Applied methods of cost-effectiveness analysis in healthcare. Oxford University Press.
- o Elliott, R., & Payne, K. (2005). Essentials of economic evaluation in healthcare. Pharma-ceutical Press

### Health statistics

- o Field, A. (2013). Discovering Statistics Using SPSS for Windows. London: Sage.
- o Greenhalgh, T. (2014). How to Read a Paper: The Basics of Evidence-Based Medicine. Chich-ester, West Sussex: Wiley John + Sons.
- o Motulsky, H. (2013). Intuitive Biostatistics: A Nonmathematical Guide to Statistical Think-ing. New York: Oxford Univ Press.
- o Straus, S. E., Howerton, L. J., Richardson, W. S., & Haynes, R. B. (2010). Evidence-Based Medicine: How to Practice and Teach it. Edin-burgh: Elsevier Ltd, Oxford.

## ▶ HEALTH ECONOMY

### Type of Examination

part of module exam

## ▶ MEDICAL STATISTICS AND DATA ANALYSIS

### Type of Examination

part of module exam



## MI-10 COLLABORATIVE SYSTEMS IN MEDICINE

Module code	MI-10
Module coordination	Anna Schmaus-Klughammer
Course number and name	Case Study International Project Management Collaborative Systems
Lecturer	Anna Schmaus-Klughammer
Semester	2
Duration of the module	1 semester
Module frequency	jährlich
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	6
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Language of Instruction	English

### Module Objective

#### COLLABORATIVE SYSTEMS:

#### Learning Outcomes of the Module:

The module "Collaborative Systems" deals with the understanding of social interaction as well as design, implementation and evaluation of IT-based systems to support social interaction.

- Students know the origin and the objectives of collaborative systems and their impact on companies and group collaboration across borders.
- The theory of scale-free networks and social network analysis are recognized as the foundation of collaborative systems.
- The terms "Web 2.0", "social software" and the possibilities of cooperations on the Internet are based on case studies.
- Students recognize the interdisciplinary approach of collaborative systems and the related implementation in form of groupware systems.

After completion of the module "Collaborative Systems" students have reached following learning objectives:

#### Professional competence:



- Students know the basics of network theory and can substantially describe how taxonomies and models of groupware and collaborative work differ.
- Students know the applications of groupware in vertical-networked health care and modern social networks.
- Students know the key indicators for the description of social networks.

### **Methodical expertise**

- Students can apply the methods of network analysis and the scale-free networks.
- Students know the methodology of sociograms and can use different software tools for network analysis apply and analyze, based on Affiliationsmat-Rizen

### **Personal competence:**

- Students can discuss and have a strong understanding of the online access and collaboration issues.

### **Social competence:**

- Students are able to discuss the legal, ethical and moral question - settings of modern social networks and their application in the field of critical communication in healthcare.

## **CASE STUDY INTERNATIONAL PROJECT MANAGEMENT:**

Learning Outcomes of the Module:

- o The students will learn relevant definitions of project management to practical telemedicine usage.
- o Students will learn how to do successful project management and how to apply this knowledge to telemedicine projects.
- o Students will learn how to use project management knowledge and produce desired results in established time frames with assigned resources.

After completion of the module "Case Study International Project Management" students have reached following learning objectives:

### **Professional competence:**

- o Knowledge of defining project management for planning, organizing and controlling international telemedicine projects.
- o Knowledge of the project manager's role.
- o Students will know the five main project management points (goal, time frame, team building, tracking, ending)



**Methodical expertise:**

Students will be able the knowledge of international project management to all future telemedicine projects, either in Low and Middle Income Countries (LMICs) or in High Income Countries (HICs).

Students have knowledge how to plan a telemedicine project, using Gantt charts and evaluating the telemedicine projects using a telemedicine software platform.

**Social competence:**

The students will work in small groups and develop a sample scenario using their knowledge about international project management.

**Applicability in other Programs**

Simulation Medical Information System

**Entrance Requirements**

none

**Learning Content**

**Collaborative Systems:**

1. Introduction to basics of collaborative systems
  - 1.1. Computer-supported.cooperative work
  - 1.2. Network Theory and Network Analysis
  - 1.3. Scale-free networks by Barabasi
  - 1.4. Self-organization in networks, autopoiesis, dissipative structures, emergence
  - 1.5. Case Study: Small world project
2. Requirements for collaborative software and Groupware
  - 2.1. Space-time taxonomy of groupware
  - 2.2. 3-K model for groupware
  - 2.3. Awareness
  - 2.4. Examples of "social software" from the Web 2.0
3. Interdisciplinary aspects of collaborative systems



- 3.1. Network analysis of social structures
- 3.2. Macro approach and micro approach social system
- 3.3. Analysis level dyad, triad
- 3.4. Sociograms and Graph Theory
- 3.5. Measures of network analysis
- 3.6. Case Study: Network Analysis
- 4. Practical examples and case studies
- 5. Collaborative Systems and Applications
  - 5.1. Collaborative Software Development in open source area
  - 5.2. Wikipedia
  - 5.3. Collaborative Tagging (del.icio.us)
  - 5.4. Collaboration platforms: Wikis, phpGroupWare, Plone, Joomla and Others..
  - 5.5. Social Inter networks: Xing, StudieVZ, Facebook
  - 5.6. Collaboration in 3D environments: Second Life, Wolrd of Warcraft, et al
  - 5.7. Commercial collaboration platforms: SharePoint Services, FastViewer

**Case Study International Project Management:**

- 1. Why Project Management
  - 1.1 Understanding Expectations - Who, what, and why of a project
- 2. What is Project Management
  - 2.1 Types of Project
  - 2.2 Classifying Projects
- 3. Project Management: Key Theoretical Concepts
  - 3.1 A systematic approach
  - 3.2 Systems Engineering
- 4. The Phase Concept
  - 4.1 The Initialization Phase
  - 4.2 The Preliminary Study Phase



4.3 The Concept Phase

4.4 The Implementation Phase

4.5 The Introduction Phase

4.6 The Utilization Phase

## Teaching Methods

Instruction Seminars, exercises

## Remarks

Exercises for network analysis with IT-assisted tools, such as NETDRAW or Gephi

## Recommended Literature

### Collaborative Systems:

Accompanying teaching materials :

- o Boettger C. (eds . ) , IX study groupware , commercial and open source groupware systems compared, Heise Verlag, 2007
- o Borghoff , U. , Schlichter, J. , computer Supported Cooperative Work , Springer Verlag , 2000
- o Case study Masterfoods USA Case Study: Driving innovation in R & D with Network Analysis?
- o Jansen , D. , Introduction to network analysis, Leske + Budrich , utb , 2nd edition , 2003
- o Koch , M. , Richter , A. , Enterprise 2.0 , Oldenbourg, Munich 2007
- o Camarina- Collaborative Systems for Smart Networked Environments : 15th IFIP WG 5.5 Working Conference on Virtual Enterprises Matos , L. M., Afsarmanesh, H. , Springer, 2014
- o ACM Conference on Computer Supported Co- operative Work and Social Computing , <http://cscw.acm.org/2014/>
- o Section CSCW & Social Computing the society for computer science , <http://www.fgcsw.de/>
- o Basic literature for deepening the knowledge:
- o Gross, T., Koch , M., Herczeg, M. , Computer Supported Cooperative Work, Oldenbourg, Munich , 2007



## Case Study International Project Management:

International Project Management

25. November 2009 by Kathrin Koster

Publisher: Sage Publications Ltd

Project Management Handbook (Management for Professionals)

25. June 2015

by Jürg Kuster (Autor), Eugen Huber (Autor), Robert Lippmann (Autor), Alphons Schmid (Autor), Emil Schneider (Autor), Urs Witschi (Autor), Roger Wüst (Autor)

Publisher: Springer; 2015 edition

### ▶ CASE STUDY INTERNATIONAL PROJECT MANAGEMENT

#### Type of Examination

part of module exam

### ▶ COLLABORATIVE SYSTEMS

#### Type of Examination

part of module exam



## MI-11 DATA SECURITY AND DATA PROTECTION

Module code	MI-11
Module coordination	Prof. Dr. Georgi Chaltikyan
Course number and name	Case Study Data Security Data Security and Data Protection
Lecturer	Christian Roth
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	English

### Module Objective

#### Learning Outcomes of the Module:

The courses of this module face the students with current cyber threats and IT security technology that supports the protection of IT infrastructures of organizations. Students will be able to understand the complexity of IT infrastructures and their weaknesses. Furthermore students will be faced in the practical case study course how it is possible to derive risks from those weaknesses and how to fix these weaknesses and create measures to avoid threats based on those weaknesses.

Another topic faces the students with the possibility of intrusion detection. Students learn the basics of cyber forensic that helps to restore destroyed data, to support intrusion detection and to find out the way that was used by attackers to break security measures and to intrude in the IT infrastructure.

Beside this, students become aware of the basics of cryptography and applied encryption. Students will be able to encrypt E-Mails, Files and Instant Messaging conversations using state of the art encryption technology.

Last but not least students are faces with special aspects of medical domain organizations and medical security standards.





Students are presented with a broad picture of the various aspects of IT security and data protection. The module consists of two courses. One course teaches the theory of IT security, data protection and cryptography and a second course (case study) faces the students with the application of the theoretical parts. The module serves as a fundamental module for master students of different domains and it creates a foundation and provides additional IT security knowledge for all other modules that faces students with medical domain specific IT solutions.

Professional competence:

- o Knowledge of the main concepts of IT Security, data protection, cryptography and cyber forensic. Students can identify and explain differences between existing concepts and apply them in their working environment. Students will be able to select proper technologies and tool chains to secure and protect stored data and conversations.
- o Knowledge about legal regulations and standards concerning information technology in the fields of medical engineering and hospital IT.
- o Knowledge of encryption mechanisms and standards. Students are able to explain the difference of symmetric and asymmetric ciphers and the difference between transport layer and end-to-end encryption. They are able to decide whether a mechanism is suited for a specific application.
- o During the courses students face practical exercises where they gain experience in analyzing threats, deriving risks and measures and creating a risk analysis.
- o Knowledge of database systems and database design. Students will be able to identify to create relational database designs that avoid data loss and data inconsistency. They are able to explain how a relational database stores data.
- o Understanding of security relevant parts of an operating system. Students are able to explain relevant mechanisms like user roles and address space layout randomization.

Methodical expertise:

- o Ability to encrypt and decrypt E-Mails, Instant Messaging conversations Files and Passwords in a secure manner. Students will be able to use proper Plugins and Tool to encrypt and decrypt data.
- o Ability to create risk analysis documents. Students are able to analyze threats and derive risks and measures in order to enhance the security of the existing IT infrastructure and the stored data.
- o Ability to transfer theoretical knowledge of IT security, data protection, cryptography, cyber forensic and legal standards to real world use cases that are often faced by medical engineering and hospital IT departments.

Personal competence:



- o Ability to understand the complexity of IT solutions and its relations to IT security and data protection. The students will be able to recognize that there is no 100 percent security. They will be able to explain that IT security is not a simple product but a complex process that supervises the internal IT infrastructure, teaches users and collects information about external IT security developments and threats.
- o Students will be able to understand and explain why well qualified and instructed users are a very important support to secure the IT infrastructure, the user, customer or patient data and the intellectual property of the organization.

Social competence:

- o Understanding of users as key factor in IT security processes. Students will be able to recognize that users are often the biggest backdoor of the IT infrastructure. Nevertheless the IT department must help users to fulfill their work in an efficient and secure way. Otherwise users will find ways around specified way. The user is always part of the solution.

## Applicability in other Programs

Essential module for the study program.

Can be used in any other study program in the field of Health IT.

## Entrance Requirements

none

## Learning Content

Operating System Security:

- o User Roles and Access Rights
- o Memory Protection
- o Address Space Layout Randomization
- o Virtualization and Sandboxes

Data Storage and Data Transport Protection:

- o Database Data protection
- o Backup Strategies
- o Disk Encryption
- o Database Encryption



- o Password Hashing
- o Application level Encryption
- o Transport Level Encryption
- o End to End Encryption
- o Message Authentication
- o Client and Server Authentication

Cryptography and Applied Encryption:

- o Encryption
- o Authentication
- o Anonymization
- o Deniability
- o Perfect Forward Secrecy
- o Design of Ciphers
- o Symmetric Ciphers
- o Asymmetric Ciphers
- o Virtual Private Networks
- o Applied Password Security
- o Applied E-Mail Security
- o Applied Instant Messaging Communication Security
- o Transport Layer Encryption
- o End to End Encryption

Risk Assessment:

- o Detection of Threats
- o Analysis of Threats
- o Assessment of Risk
- o Measure and Threat Avoidance

Threats:



- o Technical Threats
- o Organizational Threats
- o Exploits
- o Intrusion Detection and Intrusion Avoidance
- o Honey Pots

#### Digital Forensic:

- o Computer and Mobile Device Forensic
- o Network Forensic
- o Forensic Data Analysis
- o Database Forensic
- o Forensic Process
- o Forensic Techniques

#### Legal Regulations and Standards:

- o Security Standards
- o Medical Standards

#### IT Security and IT Alignment:

- o Alignment of Digital Forensic
- o Alignment of Risk Assessment
- o Management of Data Security and Data Protection

## Teaching Methods

Lectures, exercises, case study

## Recommended Literature

- o Edward K. Blum / Alfred V. Aho (2011), Computer Science: The Hardware, Software and Heart of It, Springer Science+Business Media New York.
- o Marshall Kirk McKusick / George V. Neville-Neil / Robert N. M. Watson (2014) The Design and Implementation of the FreeBSD Operating System (Second Edition), Addison-Wesley.



- o Christof Paar / Jan Pelzl / Bart Preneel (2009) Understanding Cryptography – A Textbook for Students and Practitioners, Springer
- o John R. Vacca (2013), Cyber Security and IT Infrastructure Protection, Syngress.
- o John Gomez, Colin Konschak (2015), Cyber-Security in Healthcare, Sensato.
- o Sebastian Klipper (2015), Information Security Risk Management (Edition kes, 2. Auflage), Springer Vieweg (German)

### ▶ CASE STUDY DATA SECURITY

#### **Type of Examination**

part of module exam

### ▶ DATA SECURITY AND DATA PROTECTION

#### **Type of Examination**

part of module exam



## MI-12 SOFTSKILLS

Module code	MI-12
Module coordination	Prof. Dr. Johann Nagengast
Course number and name	Intercultural and Interdisciplinary Communication
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	6
ECTS	6
Workload	Time of attendance: 67.5 hours self-study: 112.5 hours Total: 180 hours
Type of Examination	, written ex. 90 min., oral ex. 30 min.
Duration of Examination	120 min.
Language of Instruction	English

### Module Objective

Cultural and interdisciplinary differences among international business partners, customers and suppliers often result in tension and misunderstandings in the Medical World. Managers who competently navigate in different cultural and disciplinary environments can contribute substantially to the success of globally active enterprises.

A condition for the acquisition of "intercultural and interdisciplinary competence" is the recognition that one's own actions are influenced by one's own values and norms. Reflecting on one's own cultural and disciplinary background forms the basis for the understanding of other cultures and functions.

In the first part of the course the participants acquire the knowledge they need to explain and understand various cultures and disciplines. Through the study of comparative cultures they discover the relevance of the cultural framework to management theory and for explaining management behavior.

Participants learn how to independently apply the "culture assimilator" technique to broaden their knowledge through a qualitative research project. This involves soliciting international and functional managers and collecting "critical incidents" of cross cultural and cross functional business interactions, which are then analyzed with the help of theory. Carrying out qualitative interviews with members of foreign cultures und functions further develops the participants' social, cross-functional and intercultural skills.



The second part of the course is conducted as an off-campus intensive “social, interdisciplinary and intercultural competence” training workshop. Here the results of the culture-assimilator research projects are presented through roll-playing in situational reenactments. The implications are further clarified through a variety of interaction exercises. For example simulation of expatriate and cross-functional management situations is used to transfer concrete practical knowledge.

The social, interdisciplinary and intercultural competence training assists the participants in their ability to reflect on cultural and disciplinary identities, to avoid value judgements in their perception of foreign and functional cultures, to empathize and accept differences as well as to develop additional options for actions international and cross functional managers can take.

## Applicability in other Programs

Intercultural and interdisciplinary problems and challenges can be identified by the students and can be solved by students after the course in a successful manner.

All students have a full understanding of intercultural and interdisciplinary problems and know the theory by heart.

## Entrance Requirements

Fluent English skills

International and intercultural experiences (recommended)

## Learning Content

The following concepts are emphasized in theoretical discussions, research projects and in the practical training workshop:

- o What is normal?
- o Defining Culture
- o The Characteristics of Culture
- o The Functions of Culture
- o Organizational Culture
- o The Layers and Elements of Culture
- o Comparing Cultures
- o The Impact on the Individual: the “Culture Shock”
- o Cultural Contexts: Hall



- o Culture and the Workplace: Hofstede Practical Aspects of Intercultural Behavior
- o International Human Resource Development
- o Expatriate Management
- o Language and Social Reality
- o Reasons for Cross Cultural Misunderstandings
- o Improving Cross Cultural Cooperation

More topics are to be added based on the actual demand for graduates in this programme, evaluated constantly by qualitative and quantitative research of future employers

## Teaching Methods

The course begins by conveying the fundamentals of crosscultural and interdisciplinary management via theoretical lectures and moderated discussions. Since most of the participants have intercultural and interdisciplinary experiences assembled from a wide variety of cultures and functions, the theory can be directly tied to many of the individual experiences.

The theoretical fundamentals are then extended through the development, application and presentation of the culture and functional assimilators. The qualitative research projects are performed in groups organized along the principles of selforganized learning. The projects help develop individual competence in applying the scientific method and also further the development of presentation, social and intercultural skills.

Short case studies, "critical incidents", are selected from the international and interdisciplinary business world. Explanations and analysis of these cases support the integration of the participants' existing management knowledge with intercultural and interdisciplinary perspectives.

Social, interdisciplinary and intercultural skills are further developed in the training workshop through roll playing, interaction exercises, problem solving tasks, simulations and feedback rounds.

## Remarks

Led by Prof. Dr. Johann Nagengast, the course implements a multi-cultural and multifunctional team teaching approach. The teaching team offer expertise in expatriate management and international human resources and add a foreign cultural and management perspective, while various student tutors (carefully selected and already being experienced in the content of this module) assure that the participants get small group, qualified feedback.





## Recommended Literature

- o Hall, E. T., Hall, M. R.: Understanding Cultural Differences, reprint, Yarmouth, Intercultural Press (2015)
- o Hofstede, G.: Cultures and Organizations, 2nd ed., New York et al., Mc Graw-Hill (2015)
- o Hofstede, G.: Culture's Consequences, 2nd ed., Thousand Oaks, Sage, (2014)
- o Trompenaars, F., Hampden-Turner, C.: Riding the Waves of Culture, London, Brealey Publishing, (1997)
- o Trompenaars, F., Hampden-Turner, C.: Managing People across Cultures, Chichester, Capstone Publishing (2004)
- o Lewis, R. D.: When Cultures Collide, 3rd ed. (or more current), London, Brealey Publishing (2006)

## ▶ **INTERCULTURAL AND INTERDISCIPLINARY COMMUNICATION**

### **Type of Examination**

written ex. 90 min.



### **Type of Examination**

null



## MI-13 MASTER THESIS

Module code	MI-13
Module coordination	Prof. Dr. Georgi Chaltikyan
Course number and name	Master Thesis
Semester	3
Duration of the module	1 semester
Module frequency	
Course type	required course
Niveau	postgraduate
Semester periods per week (SWS)	0
ECTS	24
Workload	Time of attendance: 0 hours self-study: 720 hours Total: 720 hours
Type of Examination	presentation 20 min., master thesis
Duration of Examination	20 min.
Language of Instruction	English

### Module Objective

By producing a Master's Thesis the students should demonstrate their ability to apply the knowledge and skills acquired during the study course, in an independently written scientific work on complex tasks.

They thus demonstrate that they have successfully completed their Master's levels studies and acquired the capacity for independent scientific work.

### Entrance Requirements

According to the paragraph 7 of the Study and Examination Regulations, those students who have collected at least 40 ECTS credits may register for the Master's Thesis.

### Learning Content

The Master's Thesis is a written report in a form of a scientific paper. It describes the scientific findings, as well as the way leading to these findings. It contains justifications for decisions regarding chosen methods for the thesis and discarded alternatives. The student's own substantial contribution to the achieved results has to be evident. In addition, the student presents his work in a colloquium, in which the scientific quality and the scientific independence of his achievements are evaluated.

The work on the Master's Thesis is supervised by any of the instructors within the study course (professors or lecturers). The Master's Thesis can be written on any



subject or topic related to the content of any of the modules of the study course. The students can suggest the topics for their Master's Theses according to their research or practice preferences.

The preparation time of a Master's Thesis according to the regulations is 6 (six) months. However, an extension up to a maximum of 8 months from the subscription date is possible (§11 APO). As a general rule, the size of the thesis should not exceed 70 pages.

## Teaching Methods

Students perform an independent supervised scientific research work.

## Recommended Literature

Recommendations and instructions of writing a master's thesis (available through iLearn).

### ▶ MASTER THESIS

#### Type of Examination

presentation 20 min., master thesis

