COMPUTER ENGINEERING
GRADUATE COURSE CONTENTS

BIL523 Stochastic Processes (3 0 3 – 7.5 ECTS)

Random variables, vectors, and their functions. Limit theorems and introduction to stochastic processes.
Markov chains, Poisson processes, queueing theory, martingales, random walks, and Brownian motion.

BIL570 Natural Language Processing (3 0 3 – 7.5 ECTS)

Definition and scope of NLP. Spelling correction, statistical methods (n-grams and related models),
sentiment analysis, text summarization, information extraction, and text classification.

BIL460 Data Mining and Applications (3 0 3 – 7.5 ECTS)

Introduction to data mining. Data input: concepts, examples, attributes. Data output: knowledge representation.
Algorithms: basic methods, statistical models, decision trees, rule induction, association rules.
Linear models, instance-based learning, clustering, WEKA applications.
Bayesian networks, data transformation, and advanced linear models.

BIL522 Computer Network Architectures (3 0 3 – 7.5 ECTS)

Protocol principles. Local and wide area networks. OSI model.
TCP/IP and Quality of Service principles.
Medium access control. Error control coding.
Flow control mechanisms. Network simulation.
Network security. Wireless and optical networks.

BIL513 Artificial Neural Systems (3 0 3 – 7.5 ECTS)

Single-layer feedback networks. Associative memories.
Mapping and self-organizing networks.
Principal component analysis. Information-theoretic models.
Stochastic machines and their relationship with statistical mechanics.
Applications of neural algorithms and systems.
Implementation of neural networks.
Expert systems.
Artificial Neural Systems for discrete optimization problems.
Neural systems for prediction, identification, and estimation.

BIL512 Cloud Computing and Architecture (3 0 3 – 7.5 ECTS)

Fundamentals of cloud computing and cloud architectures.
Cloud-based server and client application models.
Processing and load-balancing optimization.
Examples of cloud computing server software.
Overview of platforms such as Windows Azure, Google Cloud, 3tera, 10geb, and Nirvani.

BIL516 Game Theory and Applications (3 0 3 – 7.5 ECTS)

Fundamental concepts and solution methods of game theory.
Normal-form, extensive-form, repeated, and Bayesian games.
Auction models and applications.

BIL517 Network Programming (3 0 3 – 7.5 ECTS)

TCP and UDP sockets, multicast protocols, servlets,
multi-threaded network programming, input/output operations.
HTML parsing and rendering.
Java Mail API and Java Secure Sockets Extension.
New I/O APIs for network programmers.

ENM305 Optimization Techniques (3 4 3 – 7.5 ECTS)

Concept of optimization.
Classical optimization theory.
Basic linear programming model.
Simplex method, Big-M method, two-phase method.
Revised simplex method, LU decomposition.
Dual simplex method.
Multi-period and multi-stage problems.
Decomposition algorithms.
Goal programming and data envelopment analysis.
Examples and general evaluation.

BIL521 Interactive Computer Graphics (3 0 3 – 7.5 ECTS)

Modeling techniques.
Two- and three-dimensional clipping.
Hidden line and surface removal.
Three-dimensional viewing.
Shading and coloring.
Texture generation.
Fuzzy object modeling.
Fractal geometry and fractal object generation.
Particle systems.
Fluid and cloth simulation.

User interface design.
Graphics file formats and software packages.

BIL530 Programmable Logic Controller (PLC) Systems (3 0 3 – 7.5 ECTS)

PLC hardware structure.
Microprocessor characteristics.
ROM and RAM organization.
Digital and analog inputs and outputs.
System keyboards and display units.
PLC programming methods and commands.
Logic functions.
Timer and counter functions.
Data processing functions.
Network structures between computers and PLCs.
PLC hardware design using microcontrollers.
PLC simulation environments.

BIL532 Circuit Design with FPGA (3 0 3 – 7.5 ECTS)

Programmable digital systems.
FPGA architecture.
Modeling of digital circuits using Verilog HDL.
Finite state machines.
Implementation of FSMs in Verilog HDL.
RTL design.
Implementation of processor components on FPGA.
Design and implementation of a simple processor on FPGA.

BIL534 Design Patterns (3 0 3 – 7.5 ECTS)

Design patterns defined by the Gang of Four (GoF).

BIL538 Fault-Tolerant Computing (3 0 3 – 7.5 ECTS)

Fault-tolerant computer architectures.
Taxonomy of fault tolerance.
High-availability systems.
Long-life systems.
Critical computing.
Fault tolerance in multiprocessor systems.
Static redundancy.
Fault detection.
Recovery strategies.
Forward recovery schemes.
Reconfiguration.
Reliability estimation.
Component and system reliability.

Combinational and Markov models.
Coverage models.
Computer-aided reliability assessment.
Fault-tolerant software.
Recovery blocks.
Reliability models for software.
Acceptance testing.
Fault trees.
Exception handling.
System diagnosis.
Bounded models.
Stochastic models.

BIL534 Wireless Networks (3 0 3 – 7.5 ECTS)

Wireless network architectures.
Operational principles of wireless networks.
Data encoding in wireless communications.
Packet structures in wireless networks.

FBE507 Computational Thinking (3 0 3 – 7.5 ECTS)

Computer concepts and terminology.
Operating systems.
Processes and files.
Open-source software.
Networks and the Internet.
Protocols.
Web servers and web languages.
Computational problems.
Data representation.
Digital images, audio, and video.
Data sharing.
Database systems.
Machine languages and high-level programming languages.
Fundamentals of software engineering.

FBE513 Scientific Research Methods and Ethics (3 3 3 – 10 ECTS)

This course provides graduate students with knowledge on how scientific research is conducted,
reported, and presented, together with ethical principles in research.

FBE500 Seminar (3 0 3 – 7.5 ECTS)

Advisors and students evaluate previous research in terms of academic writing rules.
Critical reading, comprehension, synthesis, and comparison skills are practiced.

At the end of the course, the student conducts independent research and prepares an academic paper or report.