List of courses in Software Engineering at the BME during the academic year 2013/14

Cr.	Course code	Course name	Semester	Contact hours L	S	Lab[1]	Requirement
2	BMEVIMIA312	*Measurement laboratory 3*	Fall			2	mid-semester mark
4	BMEVIIIA316	*Computer graphics and image processing*	Fall	3	1		mid-semester mark
4	BMEVITMA310	*Telecommunication networks and services*	Fall	3	1		examination
4	BMEVIMIM332	*Critical embedded systems*	Fall	2	1		mid-semester mark
5	BMEVITMA311	*Databases*	Fall	3	1		mid-semester mark
5	BMEVIMIA313	*Artificial intelligence*	Fall	3	1		mid-semester mark
4	BMEVITMA314	*Management of information systems*	Spring	3	1		examination
4	BMEVITMA364	*Protocol technologies*	Spring	3	1		examination
4	BMEVIHIA317	*Mobile infocommunication systems*	Spring	3	1		examination
4	BMEVITMA365	*IP network management*	Spring	3	1		examination
2	BMEVITMA308	*Software laboratory 5*	Spring			2	mid-semester mark
2	BMEVIHIA319	*Mobile infocommunication laboratory 1*	Spring			2	mid-semester mark

Course descriptions

	Measurement Laboratory 3		
Weekly contact hours	lecture	classroom practice	laboratory practice
	0	0	2
Requirement	mid-semester mark		
Credits	2		
Department	Department of Measurement and Information Systems		
Lecturer	*János HAINZMANN*, candidate of science, associate professor		

Course objectives:

The course presents the most important measurement devices and techniques used in computer engineering such that the students can put into practice their theoretical knowledge and to obtain skills for individually investigating complex systems. This requires preparatory work prior to measurement sessions.

Obtained skills and expertise:

Use of measurement devices and techniques in order to investigate and analyze complex systems.

Synopsis:

Testing the characteristics of A/D and D/A converters. Measurement of data channel characteristics. Investigation of simple data transfer protocols. Configuration of a PC for network connection. Creating a computer network by a manageable switch, investigation of the network.

Course prerequisites: Digital Design 2, Operating Systems

References

- User's Manuals for the measurement devices
- Detailed descriptions of the measurement tasks for each measurement session

[1] **L**: lecture; **S**: classroom practice; **Lab**: laboratory practice (hours per week)

	Computer Graphics and Image Processing		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	4		
Department	Department of Control Engineering and Information Technology		
Lecturer	*Balázs CSÉBFALVI*, PhD, associate professor		

Course objectives:

The course presents the fundamentals of computer graphics and image processing and introduces methods of creating, animating, and rendering virtual worlds.

Obtained skills and expertise:

Capability to understand and apply methods for creating, animating, and rendering virtual worlds.

Synopsis:

Fundamental concepts: tasks of the computer graphics and image processing, synthetic camera, image synthesis. Graphical hardware. Analytical geometry: vectors, coordinate frames, points. Implementation of operations on vectors. The equation of lines and planes. Geometrical modeling, Lagrange interpolation, Bezier approximation, B-Splines, NOBS and NORBS. Areas, quadratic and parametric surfaces, polygon modeling, body models. Colors: the light as electromagnetic wave, the model of color perception, color fitting, color systems. Geometric transformation. Virtual world models: hierarchical model, VRML, color space graphs. 2D image synthesis: vectorization. Modeling transformation, view transformation. Split of sections and area. 2D graphical systems: OpenGL, GLUT, color tactics, link with the windowing environment, open of the graphical window, registration of callback functions. Fundamental optical model for 3D image synthesis: flux, radiance, BRDF, shading equation. Recursive ray tracing: intersection calculation and its acceleration. Incremental 3D image synthesis. OpenGL and graphical hardware, OpenGL primitives, transformations, shading, light sources. Textures in OpenGL, control of the OpenGL pipeline. The architecture of the graphical hardware and its direct programming. Cg language, GPUGPU, CUDA. Computer animation: definition of motion, Spline, key-frame, path, physical and motion capture based animation. Forward and inverse kinemtaics. Augmented reality. Computer games: virtual worlds and the architectural concepts of games. The game engine. Realistic effects: physics of the games, terrain modeling, MD2 format, artificial intelligence of the opponents. Scientific and medical visualization (CT, MRI, PET). Direct and indirect methods. Fractals. Chaos, chaotic dynamical systems on the complex plane. IFS coding. Recording, filtering and storage of digital images. Features of the optics, cameras, digitalization and reconstruction. Image enhancement techniques: histogram equalization and transformations. Image filtering: linear operations, 2D convolution. Real-time filtering, methods of edge detection, nonlinear filtering. Image compression, file formats.

References

- Foley, van Dam, Feiner, Hughes, Phillips: Introduction to Computer Graphics, Addison-Wesley Professional, 1993
- Shirley and Marschner: Fundamentals of Computer Graphics, A K Peters; 3rd Revised edition, 2009

	Telecommunication Networks and Services		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	4		
Department	Department of Telecommunications and Media Infromatics		
Lecturer	*Tamás HENK*, PhD, associate professor		

Course objectives:
The course provides both theoretical and practical knowledge about telecommunication networks including the most important skills to understand the internal services and functioning of such networks, to select and apply system level components and to design, support and integrate networks of different service providers.

Obtained skills and expertise:

Understanding the internal services and functioning of telecommunication networks, selection and application of system level components, ability to design, support and integrate networks of different service providers.

Synopsis:

Architecture of telecommunication networks. Network hierarchies, numbering plans, signaling systems and signaling protocols. Telecommunication technologies: wired and wireless access, backbones. Plesiochronous Digital Hierarchy, Synchronous Digital Hierarchy, Asynchronous Transfer Mode and optical networks. Telecommunication systems: Public Switched Telephone Networks, Global System Mobile, Voice over IP. Convergence of telecommunication-, computer- and broadcast networks. Software and hardware elements of telecom systems. Telecom software technology. Specification of telecom software. Infocom services. Teleservices. Message, data, voice and conference services. Content services. Video on Demand, Internet services. Web portals and services, media information systems, electronic commerce, electronic civic centre. Broadband integrated services. Authentication, authorization, and accounting.

Course prerequisites: Computer Networks

References

- J. C. Bellamy: Digital Telephony. Wiley, New York, 2000.

S. S. Jones, Editor: The Basics of Telecommunications, International Engineering Consortium, Chicago, 2004.

	Critical Embedded Systems		
Weekly contact hours	lecture	classroom practice	laboratory practice
	2	1	0
Requirement	mid-semester mark		
Credits	4		
Department	Department of Measurement and Information Systems		
Lecturer	*Dániel VARRÓ*, DSc, associate professor, *István MAJZIK*, PhD, associate professor,		

Course objectives:

Dependability is a critical aspect for the design of safety-critical embedded systems (avionics, automotive, medical, etc.) where a system failure may result in severe losses or casualties. The course aims to overview the main development, verification and validation principles and technologies of critical embedded systems.

Obtained skills and expertise:

Principles and basic expertise in designing critical embedded systems and software.

Synopsis:

The course will cover the following topics

- Development process of safety-critical systems: Main concepts. Safety criteria (in avionics, railways, automotive context). Related certification standards (IEC 51508, DO178C), safety integrity level, requirements engineering, architecture design, safety analysis, concept of safety case, development processes (V-model), end-to-end traceability
- Development techniques of critical systems: Formal architecture modeling (SysML, AADL), Execution platforms (ARINC 653, AUTOSAR), Programming languages for critical systems design (Safe C, Real-Time Java, Safety Critical Java), Certified code generators, Verification and validation of critical systems
- Case studies: architecture design, resource allocation, scheduling, implementation and testing in the field of avionics and automotive systems

References

- Zurawski, R.(Editor), Embedded Systems Handbook. CRC Press, Boca Raton;London;New York, 2006. ISBN 0-8493-2824-1.
- Marwedel, P., Embedded System Design. Springer;Berlin, 2003. ISBN 1-4020-7690-8.

	Databases		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	5		
Department	Department of Telecommunication and Media Informatics		
Lecturer	*Gyula KATONA*, PhD, associate professor		

Course objectives:

The objective of the course is to present elementary concepts and methods related to the use, maintenance and design of database management systems together with application examples.

Obtained skills and expertise:

Capacity to apply the selected concepts and methods in database management.

Synopsis:

Database concepts, history, entity-relationship model/diagram, attributes, relation-types, constraints, weak entity sets. Relational database, relational algebra, extended operations, design from E/R model. Tuple relational calculus, domain relational calculus, safe expressions, completeness. Introduction to ISBL, QUEL, QBE. SQL queries: basic structure, set operations, aggregate functions, NULL values, subqueries, SQL Data Manipulation Language, SQL Data Definition Language. Functional dependencies, logical consequence, Armstong axioms, derivation rules, key, closure, multivalued dependency, decompositions, normal forms. Transaction management: serializability, precedence graph, locks, deadlocks, 2PL, RLOCK/WLOCK, tree protocol, timestamps, logging, UNDO/REDO protocols.

Course prerequisites:

References

- Jeffrey D. Ullman, Jennifer Widom: First Course in Database Systems, 3rd Edition, Prentice Hall, 2007

	Artificial Intelligence		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	5		
Department	Department Measurement and Information Systems		
Lecturer	*Tadeusz DOBROWIECZKI*, PhD, associate professor		

Course objectives:

The objective of the course is to provide a short but exigent presentation of the field of artificial intelligence in tree main steps: (1) expression of intelligent behavior by computational models; (2) analysis and application of formal methods and heuristics used in artificial intelligence; (3) methods and problems of practical applications.

Obtained skills and expertise:

The students satisfying the course requirements will be able to (1) understand and study a new way of computer usage; (2) develop efficient algorithms for computational problems; (3) understand the limits of current information and computation technologies; (4) to intellectually perceive the central role of algorithms in information processing systems.

Synopsis:

Agent paradigm: Intelligent system and its environment. Formal modeling and solving of complex problems within agent paradigm. Comparing problem solving methods (search strategies). Heuristics for reducing complexity. Knowledge intensive approach and complexity. Experimenting with the scheduling problems: modeling within the paradigm and solving with the search algorithms. Planning: Planning as a tool of problem solving. Basic representations for planning. The basics of the modern planning algorithms. Hierarchical and conditional planning. The question of the resource constraints. Integrated planning and execution. Experimenting with the assembly problems: developing plans taking into account various problems of increasing complexity. Knowledge intensive systems. Formal representation and manipulation of knowledge. Logic based methods. Using first order logic to describe problems and to compute solutions. The functioning of rule-based systems. Inference methods for uncertain knowledge. Probabilistic inference systems. Representing vague meaning with fuzzy sets. Experimenting with the diagnostic problem with knowledge of different levels of uncertainty, using suitable methods, or experimenting with building a fuzzy system (rule-based language, fuzzy software packages, etc.). Learning. Learning within agent paradigm. Inductive logical learning (decision trees, learning general logical expressions). Learning in neural and Bayesian networks. Reinforcement learning. Genetic algorithms and evolutionary programming. Experimenting with multiple learning problems, using suitable software packages.

Course prerequisites: Theory of Algorithms

References

Russell and Norvig: Artificial Intelligence: Modern Approach, Prentice Hall; 1st edition, 1995

	Management of Information Systems		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	4		
Department	Department of Telecommunications and Media Informatics		
Lecturer	*Gábor MAGYAR*, PhD, associate professor		

Course objectives:

The objective of the course is to teach the maintenance and system administration tasks of computers and networked information systems. The course provides a system level overview about the information systems and about the tasks of system administrators in a broad sense.

Obtained skills and expertise:

Students satisfying course requirements will be able to carry out system administration and maintenance tasks on single computers and in networked information systems.

Synopsis:

System-level overview and architectures. Strategic level design, implementation and operation tasks. Life cycle of information systems. Total Cost of Ownership, TCO management. Typical architectures, central, client-server, 3-layer schemas. Quality of Services. Reliability, Availability, Serviceability (RAS). Manageability. Asset management, system management, server management, network management,. inventory management, configuration management, power management, Structure of Management Information (SMI). Management Information Base (MIB). Internet Standard MIB, Private MIB. Common Information Model (CIM). Management Object Format (MOF). Simple Network Management Protocol (SNMP). Windows Management Interface (WMI), Web-Based Enterprise Management (WBEM). Standards. Integrated Network and System Management (INSM). Management Information Format (MIF). Desktop Management Task Force (DMTF). Desktop Management Interface (DMI)., Management Interface (MI), Advanced Configuration and Power Interface (ACPI), Boot Integrity Service (BIS). Interoperability issues. Operating tasks. System log, event management, fault management. Data storage management. Scalability basics. Maintenance, maintenance strategies. Documentation standards. Software upgrade.

Course prerequisites: Telecommunication Networks and Services

References

Limoncelli, Hogan: The Practice of System and Network Administration, Addison-Wesley Professional, 2007. ISBN-10: 0321492668, ISBN-13: 9780321492661

	Protocol Technologies		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	4		
Department	Department of Telecommunications and Media Informatics		
Lecturer	*Rolland VIDA*, PhD, associate professor		

Course objectives:

This course provides both theoretical and practical knowledge in the methodology of specification, implementation and conformity testing of communication protocols based on the theory of finite automata. The application of formal descriptor languages in the protocol technology is also presented and case studies allow understanding the signaling protocols of different communication networks.

Obtained skills and expertise:

Protocol design and analysis

Synopsis:

The methodology of protocol specification, implementation and conformity testing. The Specification and Description Language (SDL). Description of the structure and behavior of infocommunication systems. Application of the object oriented paradigm in typical communication systems. Case study: the INitiator RESponder protocol. The Test and Test Control Notation (TTCN) and the Abstract Syntax Notation No. 1. data descriptor languages and their application methodologies. Signaling systems in communication networks: Signaling System No1 and the Common Signaling System No7 (Message Transfer Part, ISDN User Part, Signaling Connection Control Part, Transactions CAPabilities, Application Part, Mobile Application Part). The H.323 multimedia architecture, system components, protocols. The Session Initial Protocol and its applications. Addressing techniques in convergent networks, the tElephone NUmber Mapping (ENUM). Functional elements of the Internet Multimedia Subsystem and the softswitch architecture. Realization of cooperation between different networks on signaling and information transmission level.

Course prerequisites: enrollment to the Study Specialization Block

References

- Alexander R. Galloway: Protocol, MIT Press, 2008

	Mobile Infocommunication Systems		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	4		
Department	Department of Telecommunications		
Lecturer	*Sándor IMRE*, DSc, full professor		

Course objectives:

The course gives an overview of functionalities and operation principles of today's and tomorrow's mobile communication systems in order to provide developer and operator engineers with information of the transmission capabilities and possibilities of networks comprising mobile components.

Obtained skills and expertise:

Analysis of mobile systems, design of mobile services

Synopsis:

Fundamental principles of mobile communication. Differences between the wired and wireless worlds and the technical problems arising from these differences. General construction of mobile networks. Personal Area Networks: Bluetooth, Zigbee, UWB, RFID. Local area networks: WLAN (802.11), HiperLAN, Metropolitan Area Networks: GSM, GPRS, UMTS. Satellite networks.

Course prerequisites: enrollment to the Study Specialization Block

References

- Tony Wakefield, Dave McNally, David Bowler, Alan Mayne: Introduction to Mobile Communications: Technology, Services, WBM, 2006

	IP network management		
Weekly contact hours	lecture	classroom practice	laboratory practice
	3	1	0
Requirement	exam		
Credits	4		
Department	Department of Telecommunications and Media Informatics		
Lecturer	*Róbert SZABÓ*, PhD, associate professor		

Course objectives:

The course aims to give a comprehensive, both theoretical and practical overview about the management systems operating on current infocommunication networks (principles, architectures, technologies, protocols and realizations).

Obtained skills and expertise:

Ability of practical network management and supervision

Synopsis:

Introduction to network management, motivation, management sections, management forums. Data acquisition (monitoring) and control. Management systems: Telecommunications Management Network (TMN), OSI management systems. Internet management framework: management architecture, data acquisition methods, Internet management scheme – MIB structure and objects -, Simple Network Management Protocol (SNMP). Remote monitoring (RMON) – statistics collection. New management trends: policy based management, distributed management and self managing networks. Service management aspects of services and technologies: voice, data, and video services, broadband access technologies, new generation of services. Resource management. Service creation and management. Service Level Agreements (SLA).

Course prerequisites: enrollment to the Study Specialization Block

References

- Andrew S. Tannenbaum: Computer Networks, Wiley, 2004

	Software Laboratory 5		
Weekly contact hours	lecture	classroom practice	laboratory practice
	0	0	2
Requirement	mid-semester mark		
Credits	2		
Department	Department of Telecommunication and Media Informatics		
Lecturer	*Sándor GAJDOS*, professor		

Course objectives:

The objective of this course is to give to the students a solid practical background of the methods presented during lectures and classroom practices of the Databases course.

Obtained skills and expertise:

Application of methods presented during lectures and classroom practices.

Synopsis:

The course provides practical and technological knowledge related to some selected topics of database management. Topics include: Oracle system, the SQL language, application development using client-server architecture, creation of dynamic web pages using PHP, XML based application development, Oracle portal development.

Course prerequisites: Databases

References

- J.D. Ullman: Principles of Data Base and Knowledge-Based Systems Comp. Sci. Press 1989.

	Infocommunication Network and Services Laboratory 1		
Weekly contact hours	lecture	classroom practice	laboratory practice
	0	0	2
Requirement	mid-semester mark		
Credits	4		
Department	Department of Telecommunications and Media Informatics		
Lecturer	*Zalán HESZBERGER*, PhD, assistant professor		

Course objectives:

The objective of the course is to provide a solid practical background to the topics taught in the Infocommunication Networks Study Specialization Block.

Obtained skills and expertise:

Thanks to the hands-on measurements, the students get practical skills related to a wide range of selected topics in the field of Infocommunication Networks.

Synopsis:

The following topics are given for the measurement sessions:

1. IP basics
2. IP path selection
3. Firewall management
4. Voice over IP technologies
5. Wireless LAN
6. Datamining
7. P2P networks

Course prerequisites: enrollment to the Study Specialization Block

References

Measurement instructions for each session