EFFECTS OF EDUCATION THE MAJOR

Faculty of Computer Science and Management

Study major – COMPUTER SCIENCE (INF)

Degree of the studies - second

Profile of the studies - general academic

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
	KNOWLEDGE	
K2INF_W01	Extended and deepened knowledge of mathematics, physics or chemistry useful to formulate and solve complex problems in the scope of computer science	T2A_W01
K2INF_W02	Detailed knowledge with regard to study majors linked to computer science major	T2A_W02 T2A_W04
K2INF_W03	Arranged, theoretically grounded key knowledge with regard to business modeling and specifications of requirements of IT systems	T2A_W03 T2A_W07
K2INF_W04	Arranged, theoretically grounded key knowledge with regard to implementation distributed IT systems	T2A_W03 T2A_W07
K2INF_W05	Arranged, theoretically grounded key knowledge with regard to advanced methods of data analysis	T2A_W03 T2A_W07
K2INF_W06	Achieves results in the KNOWLEDGE category for one of the following specialisations: 1. Safety and Reliability of IT Systems (BINSI) (Appendix 1) 2. Intelligent IT Systems (ISI) (Appendix 2) 3. Internet and Mobile Technologies (ITM) (Appendix 3) 4. Software Engineering (IO) (Appendix 4) 5. Designing IT Systems (PSI) (Appendix 5) 6. Database Systems (SBD) (Appendix 6) 7. Information Systems (SI) (Appendix 7) 8. Decision Support Systems (SWD) (Appendix 8) 9. Data Communication (TEL) (Appendix 9) 10. Computer Engineering (CE) (Appendix 10) 11. Intelligent Information Systems (IIS) (Appendix 11) 12. Information Technology (IT) (Appendix 12)	
	SKILLS	

K2INF_U01	Able to acquire information from literature, databases and other properly selected sources, also in English or other foreign language regarded as language of international communication in the field of study specialisation; able to integrate acquired information, interpret and critically assess it as well as draw conclusions and formulate and exhaustively justify opinions	T2A_U01
K2INF_U02	Able to communicate using various techniques in the professional environment and in other environments, also in English or other foreign language regarded as language of international communication in the field of study specialisation	T2A_U02
K2INF_U03	Able to prepare a scientific study in Polish and a short scientific article in a foreign language regarded as the basic for science fields and scientific disciplines relevant for the study specialisation showing the author's own scientific research findings	T2A_U03
K2INF_U04	Language skills with regard to science fields and scientific disciplines relevant for the study specialisation, consistent with the requirements specified – for one language - for level B2+ of the European Language Education Description System and for the second language – level A1	T2A_U06
K2INF_U05	Able to - when formulating and solving the engineering tasks - integrate knowledge of science fields and scientific disciplines relevant for the study specialisation and use system approach, taking also account of extra-technical aspects	T2A_U10
K2INF_U06	Able to solve tasks involving creation of models, analyses and decision-making for various types of objects	T2A_U09 T2A_U11
K2INF_U07	Able to solve complex engineering task using advanced programming techniques	T2A_U18
K2INF_U08	Achieves results in the SKILLS category for one of the following specialisations: 1. Safety and Reliability of IT Systems (BINSI) (Appendix 1) 2. Intelligent IT Systems (ISI) (Appendix 2) 3. Internet and Mobile Technologies (ITM) (Appendix 3) 4. Software Engineering (IO) (Appendix 4) 5. Designing IT Systems (PSI) (Appendix 5) 6. Database Systems (SBD) (Appendix 6) 7. Information Systems (SI) (Appendix 7) 8. Decision Support Systems (SWD) (Appendix 8) 9. Data Communication (TEL) (Appendix 9) 10. Computer Engineering (CE) (Appendix 10) 11. Intelligent Information Systems (IIS) (Appendix 11) 12. Information Technology (IT) (Appendix 12) Information Technology (IT) (Appendix 12)	
SOCIAL COMPETENCES		
K2INF_K01	Able to think and act in a creative and enterprising manner	T2A_K06
K2INF_K02	Aware of technical university graduate's social role, especially understands the need of formulation and communication	T2A_K07

	of information and opinions concerning technological accomplishments and other aspects of engineering operations to the society, in particular through the mass media; makes efforts to transfer such information and opinions in a commonly understandable manner along with justification of various points of view	

Appendix 1

Effects of education in major: computer science, 2nd degree, general academic
Specialization: Safety and Reliability of IT Systems (BINSI)

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
KNOWLEDGE		
K2INF_W06_S2BIN_W01	Extended and deepened knowledge of advanced engineering of security of IT systems and computer networks as well as intelligent and distributed quantum cryptographic systems; deepened knowledge of systems preventing and detecting security breaches in IT communication, information and business infrastructure	T2A_W01 T2A_W05
K2INF_W06_S2BIN_W02	Detailed knowledge with regard to mathematic, IT and quantum cryptographic systems. Knows thoroughly mathematical models of reliability and diagnostics of technical and internet systems; deepened knowledge of methods of artificial intelligence used for analyses of security systems and diagnostics	T2A_W02
K2INF_W06_S2BIN_W03	Theoretically grounded detailed knowledge associated with diagnostics, testing and reliability of IT systems and computer networks; knowledge of security modeling, risk analysis and methodologies of building and auditing security systems and reliability of information and internet processes; knowledge of methods and tools used in cyberattacks and defensive methods; detailed knowledge with regard to safety management in IT systems	T2A_W04
K2INF_W06_S2BIN_W04	Knowledge of development trends and the most important new achievements related to the scope of application of methods of artificial intelligence and advanced data processing systems for the needs of security engineering; knows models, methods and mechanisms of cryptographic protection in data centres, virtual reality systems as well as large-scale community websites and business systems	T2A_W05
K2INF_W06_S2BIN_W05	Knows basic and advanced methods, techniques and tools of solving complex engineering tasks and projects in the field of analysis, design, implementation on manufacturing platforms, security testing and auditing of applications and IT	T2A_W07

	systems with databases and data warehouses as well as cloud processing systems; knows basic technical and legal standards and regulations regarding network and internet security	
SKILLS		
K2INF_U08_S2BIN_U01	Able to design and build security system for complex network or internet IT system	T2A_U15 T2A_U18 T2A_U19
K2INF_U08_S2BIN_U02	Able to model and implement application or system with cryptographic function	T2A_U16
K2INF_U08_S2BIN_U03	Able to reproduce, remove the effects and prevent attacks and security breach incidents	T2A_U07 T2A_U08 T2A_U09 T2A_U11 T2A_U17
K2INF_U08_S2BIN_U04	Able to build a model of reliability or diagnostics of IT system	T2A_U03
K2INF_U08_S2BIN_U05	Able to build a comprehensive security and audit system for a company or corporation operating in full design-implementation cycle; able to manage corporate functioning cycle or corporate security system; able to learn within the scope of new security internet technologies	T2A_U05 T2A_U08 T2A_U15
K2INF_U08_S2BIN_U06	Able to perform risk analysis in different areas of security of a business with network and internet infrastructure; able to perform the role of security administrator of IT system	T2A_U15 T2A_U16
K2INF_U08_S2BIN_U07	Able to select and configure a system of monitoring, detection and prevention of internet and network attacks and security breach incidents aimed at infrastructure and internet and network services as well as business systems	T2A_U09 T2A_U11 T2A_U12 T2A_U16 T2A_U19
K2INF_U08_S2BIN_U08	Able to design and implement a system protecting data of average scale business website or social networking site	T2A_U17 T2A_U18 T2A_U19
K2INF_U08_S2BIN_U09	Able to practically use advanced IT security methods, techniques and tools in manufacturing and production environments of applications and IT systems with databases and data warehouses as well as cloud processing systems	T2A_U12 T2A_U18
K2INF_U08_S2BIN_U10	Able to apply technical and legal standards and regulations regarding network and internet security	T2A_U15 T2A_U17

Effects of education in major: computer science, 2nd degree, general academic
Specialization: Intelligent IT Systems (ISI)

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
KNOWLEDGE		
K2INF_W06_S2ISI_W01	Deepened knowledge of machine learning methods, including classification of learning systems, fields of their application, requirements with regard to preparation of teaching data to particular methods and applications as well as relevant validation procedures	T2A_W04 T2A_W07
K2INF_W06_S2ISI_W02	Knows classification of optimisation methods inspired by nature, different approaches used in evolutionary calculations in detail, their applications as well as relevant methods for implementation methodology, familiar with different types of artificial neural networks as well as their learning methods, the scopes of their application and validation procedures.	T2A_W03 T2A_W04
K2INF_W06_S2ISI_W03	Detailed knowledge in the field of image and video analysis, knowledge concerning particular measures necessary to analyse various images at various angles as well as basic knowledge of image interpretation.	T2A_W04 T2A_W07
K2INF_W06_S2ISI_W04	Basic knowledge in the field of formal description of the natural language as well as construction of intelligent systems processing statements in the natural language. Knows basic language resources and tools as well as the current condition of language technologies for English and Polish.	T2A_W04 T2A_W07
K2INF_W06_S2ISI_W05	Knowledge of methods of acquisition of knowledge from data of different types (numeric, symbolic, text, image) as well as their potential applications and validation.	T2A_W04 T2A_W05
SKILLS		
K2INF_U08_S2ISI_U01	Able to formulate a machine learning task relevant to the actual problem and select machine learning method appropriate to the tasks.	T2A_U18 T2A_U15
K2INF_U08_S2ISI_U02	Able to select relevant methods of preliminary processing of input data and validation of the received results depending on the machine learning method. Able to implement chosen methods and procedures.	T2A_U08 T2A_U15

K2INF_U08_S2ISI_U03	Able to select and assess metaheuristics modelled after nature to solve practical optimisation tasks.	T2A_U08 T2A_U12 T2A_U16
K2INF_U08_S2ISI_U04	Able to assess and select appropriate type of neural network and its architecture for practical task, carry out learning and validation process, prepare a recommendation for practical use.	T2A_U08 T2A_U12
K2INF_U08_S2ISI_U05	Able to select proper steps (subtasks) for a given images analysis task, able to select relevant subtask solving method for each step. Able to implement the solution and analyse the results.	T2A_U08 T2A_U12 T2A_U16
K2INF_U08_S2ISI_U06	Able to use natural language engineering methods in construction of intelligent data mining systems and practical systems mining information from a text. Able to set up basic language resources and tools in a proper string processing natural language.	T2A_U07 T2A_U05
K2INF_U08_S2ISI_U07	Able to select appropriate method of acquisition of knowledge from data for an actual problem. Able to effectively use a selected method, to carry out validation of obtained knowledge.	T2A_U12 T2A_U16 T2A_U18
K2INF_U08_S2ISI_U08	Knows fluently types of language tools and their availability, able to set up and use them accordingly.	T2A_U07
K2INF_U08_S2ISI_U09	Basic skills with regard to formal description of the natural language as well as construction of intelligent systems processing statements in the natural language.	T2A_U10 T2A_U17
K2INF_U08_S2ISI_U10	Able to select and adequately combine various types of data, including numerical, symbolic, text and image data, into a single decision support system.	T2A_U10 T2A_U17 T2A_U19

Effects of education in major: computer science, 2nd degree, general academic
Specialization: Internet and Mobile Technologies (ITM)

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
KNOWLEDGE		
K2INF_W06_S2ITM_W01	Theoretically grounded detailed knowledge; knows methods and tools as well as able to solve complex tasks related to modeling and analysis of web systems.	T2A_W03 T2A_W04 T2A_W07
K2INF_W06_S2ITM_W02	Detailed knowledge with regard to architecture and functioning of the Internet and web services as well as methods and techniques of solving complex engineering tasks in the field of measurements and examination of the Internet.	T2A_W04 T2A_W05 T2A_W07
K2INF_W06_S2ITM_W03	Detailed knowledge with regard to computer graphics, processing and sharing media data, designing interfaces of multimedia computer applications as well as development trends and the most important new achievements in the field of modern multimedia technologies. Knows and understands basic notions and principles in the field of copyright.	T2A_W02 T2A_W05 T2A_W10
K2INF_W06_S2ITM_W04	Knows basic programming methods, techniques and tools used when solving complex engineering tasks in designing and construction of mobile systems. Knowledge essential to understand social and economic determinants of engineering operations as well as their inclusion in practice of design and construction of mobile systems.	T2A_W02 T2A_W07 T2A_W08
K2INF_W06_S2ITM_W05	Extended and deepened knowledge of architecture of distributed and parallel systems as well as distributed and parallel processing methods.	T2A_W04 T2A_W05 T2A_W07
SKILLS		
K2INF_U08_S2ITM_U01	Able to plan and carry out experiments, including computer measurements and simulations for web systems and the Internet as well as interpret the obtained results and draw correct conclusions.	T2A_U08 T2A_U09 T2A_U18
K2INF_U08_S2IT	Able to use simulation and experimental methods to formulate and solve research tasks and problems of various degree of difficulty concerning web systems as well as assess their usefulness.	T2A_U8 T2A_U09

M_U02		T2A_U18
K2INF_U08_S2IT M_U03	Able to specify the requirements for services and systems implemented using the Internet infrastructure, assess the usefulness and possibility of using modern solutions for implementation of those services as well as perform critical analysis and evaluation of constituent elements of those solutions such as devices systems, methods, basic services, etc.	T2A_U12 T2A_U15
K2INF_U08_S2IT M_U04	Able to build a research post and use its measurement tools used to evaluate the quality of services provided on the Internet.	T2A_U08 T2A_U12
K2INF_U08_S2IT M_U05	Able to work individually and in a team using electronic information communication as well as exchange and management techniques (in Polish and in English) to implement own and team IT projects, especially concerning preparation and implementation of IT applications.	T2A_U02 T2A_U07
K2INF_U08_S2IT M_U06	Able to formulate and test hypotheses related to engineering problems and simple research problems, able to select and use appropriate techniques and technologies for implementation of IT solutions related to the studied field, able to perform a critical analysis of functioning of prepared solution and suggest improvements in used techniques.	T2A_U11 T2A_U12 T2A_U15 T2A_U16
K2INF_U08_S2IT M_U07	Able to design and implement an IT project related to Internet engineering, distributed or parallel systems with observance of the assumed schedule of the implemented project, taking into account the initial requirements, using mastered techniques of implementation of such projects.	T2A_U19
K2INF_U08_S2IT M_U08	Ability to build distributed applications, combine applications operating in different environments and applications operating in mobile systems.	T2A_U07 T2A_U12 T2A_U15 T2A_U17 T2A_U18
K2INF_U08_S2IT M_U09	Able to identify and describe multimedia system user's requirements. Ability to select tools for designing, implementation and management of the manufacturing process and effective distribution of a multimedia application.	T2A_U12 T2A_U15 T2A_U17 T2A_U18 T2A_U19
K2INF_U08_S2IT M_U10	Ability to select appropriate mobile technology. Able to design and implement a mobile application and estimate the costs of its implementation and operation.	T2A_U12 T2A_U15 T2A_U17 T2A_U18

Effects of education in major: computer science, 2nd degree, software engineering

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
	KNOWLEDGE	
S2IO_W01	Extended and deepened knowledge of mathematics, physics or chemistry useful to formulate and solve complex problems in the scope of computer science	T2A_W01
S2IO_W02	Detailed knowledge with regard to study majors linked to computer science major	T2A_W02
S2IO_W03	Arranged, theoretically grounded key knowledge with regard to business modeling and specifications of requirements of IT systems	T2A_W03 T2A_W07
S2IO_W04	Arranged, theoretically grounded key knowledge with regard to implementation distributed IT systems	T2A_W03 T2A_W07
S2IO_W05	Arranged, theoretically grounded key knowledge with regard to advanced methods of data analysis	T2A_W03 T2A_W07
S2IO_W06	Arranged, extended knowledge regarding design complex software systems, including quality requirements, including designing human-computer interactions, production of software using service-based models and architecture	T2A_W04 T2A_W07 T2A_W08
S2IO_W07	Knows applied good practices, tools as well as agile and classic methodologies used in software management and production process, including the human aspect. Knows life cycle of IT project, principles of organisation of production team, planning (including estimation of costs and time of production and quality of software) and monitoring project implementation	T2A_W03 T2A_W07 T2A_W08 T2A_W09
S2IO_W08	Detailed knowledge of selected metrics and models used for data exploration in software engineering, in particular models of prediction (e.g. of defects in software or effort related to creation of software), development and evaluation of those models	T2A_W04 T2A_W08
S2IO_W09	Arranged knowledge with regard to models of integration of IT systems, e.g. using computing cloud, as well as knows methods and tools of integration of IT systems on the basis of service-oriented architecture	T2A_W04 T2A_W05 T2A_W07
S2IO_W10	Knows the most recent accomplishments related to software engineering regarding, e.g. applied practices, methodologies, technologies, tools	T2A_W05
	SKILLS	
S2IO_U01	Able to acquire information from literature, databases and other properly selected sources, also in English or other foreign language regarded as language of international communication in the field of study specialisation; able to	T2A_U01

	integrate acquired information, interpret and critically assess it as well as draw conclusions and formulate and exhaustively justify opinions	
S2IO_U02	Able to communicate using various techniques in the professional environment and in other environments, also in English or other foreign language regarded as language of international communication in the field of study specialisation	T2A_U02
S2IO_U03	Able to prepare a scientific study in Polish and a short scientific article in a foreign language regarded as the basic for science fields and scientific disciplines relevant for the study specialisation showing the author's own scientific research findings	T2A_U03
S2IO_U04	Language skills with regard to science fields and scientific disciplines relevant for the study specialisation, consistent with the requirements specified for level B2+ of the European Language Education Description System	T2A_U06
S2IO_U05	Able to - when formulating and solving the engineering tasks - integrate knowledge of science fields and scientific disciplines relevant for the study specialisation and use system approach, taking also account of extra-technical aspects	T2A_U10
S2IO_U06	Able to solve tasks involving creation of models, analyses and decision-making for various types of objects Empirical research in information technology	T2A_U09 T2A_U11
S2IO_U07	Able to solve complex engineering task using advanced programming techniques	T2A_U18
S2IO_U08	Able to plan and carry out evaluation of quality of various artifacts produced in the production process - from the stage of definition of requirements, through definition of system architecture up to production code and tests. Able to design and perform unit, integration, system or acceptance tests.	T2A_U09 T2A_U15
S2IO_U09	Able to - in accordance with set specification - design and implement a complex software system, using relevant methods, techniques (also information-communication techniques) and tools, including by adapting existing or preparing new tools for this purpose.	T2A_U07 T2A_U19
S2IO_U10	Able to prepare and present a multimedia presentation regarding detailed issues related to software engineering in Polish and English.	T2A_U04
S2IO_U11	Able to carry out initial business analysis and feasibility study of an IT project system and analyse the risk. Able to plan IT project, taking the human aspect into consideration. Able to form a team and perform different roles in it.	T2A_U14 T2A_U17
S2IO_U12	Able to plan and carry out empirical evaluation of selected models used for data exploration in software engineering, in particular models of prediction (, e.g. of defects in software or efforts related to creation of software), interpret the obtained results and draw conclusions.	T2A_U08 T2A_U09
S2IO_U13	Able to suggest improvements in selected models used for data exploration in software engineering, in particular models of prediction (, e.g. of defects in software or efforts related to creation of software) as well as integrate knowledge of software engineering and mathematical statistics or machine learning	T2A_U10 T2A_U16
S2IO_U14	Able to plan and carry out integration of IT systems, including systems with service-based architecture, e.g. SOA, operating in computational cloud.	T2A_U10 T2A_U19

S2IO_U15	Able to plan experiments with regard to software engineering and participate in their implementation, formulate and test research hypotheses, interpret the obtained results and draw conclusions.	T2A_U08 T2A_U11
S2IO_U16	Able to assess usefulness and the possibility to use new solutions (e.g. practices, methodologies, technologies, tools) in software engineering	T2A_U12 T2A_U18
S2IO_U17	Able to - also using conceptually new methods of software engineering, e.g. concerning agile methodologies - solve complex engineering tasks, including tasks being an element of research in the field of empirical software engineering	T2A_U18
	SOCIAL COMPETENCES	
S2IO_K01	Able to think and act in a creative and enterprising manner	T2A_K06
S2IO_K02	Aware of technical university graduate's social role, especially understands the need of formulation and communication of information and opinions concerning technological accomplishments and other aspects of engineering operations to the society, in particular using mass media; makes efforts to transfer such information and opinions in a commonly understandable manner along with justification of various points of view	T2A_K07

Appendix 5

Effects of education in major: computer science, 2nd degree, general academic profile specialty: Designing IT Systems

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
	KNOWLEDGE	
K2INF_W06_S2PSI_W01	Deepened knowledge related to management of IT project, knows IT tools supporting management of this type of project	T2A_W02 T2A_W04
K2INF_W06_S2PSI_W02	Deepened and systematised knowledge of methods, tools and standards used for representation, searching, processing and making available any information and knowledge in IT systems, including data and information integration methods and models applied on the Internet.	T2A_W04 T2A_W05 T2A_W07
K2INF_W06_S2PSI_W03	Deepened and systematised knowledge of technologies used for implementation of IT systems on the Internet, including agent and multi-agent technologies and related design methodologies as well as tools of integration of IT systems.	T2A_W02 T2A_W03 T2A_W07

K2INF_W06_S2PSI_W04	Knows advanced methods of modeling users and personalisation of IT systems, including designing personalised, smart, adaptive web mobile and user interfaces, knows methods of examination of usefulness and principles of their application in evaluation of IT systems.	T2A_W02 T2A_W05 T2A_W07
K2INF_W06_S2PSI_W05	Deepened knowledge of advanced methods of computational intelligence used in modern information systems; knows the models of integration of those methods in IT systems.	T2A_W01 T2A_W02 T2A_W05
SKILLS		
K2INF_U08_S2PSI_U01	Able to manage a team implementing a complex IT project based on advanced knowledge representation and processing methods, in particular estimate its size, costs and time of completion.	T2A_U07 T2A_U10 T2A_U18
K2INF_U08_S2PSI_U02	Able to use IT tools supporting management of a team implementing a complex IT project based on advanced knowledge representation and processing methods as well as use those tools to effectively manage implementation of an IT project.	T2A_U07 T2A_U10
K2INF_U08_S2PSI_U03	Able to properly select method, tool and standard to solve a problem involving representation, searching, processing and or making available information and knowledge in IT systems, in particular for the class of IT systems operating on the Internet.	T2A_U10 T2A_U17 T2A_U18
K2INF_U08_S2PSI_U04	Able to properly design and verify the component of IT system performing data and knowledge integration, in particular for the class of IT systems operating on the Internet.	T2A_U10 T2A_U08 T2A_U11 T2A_U16 T2A_U19
K2INF_U08_S2PSI_05	Able to properly select advanced method of computational intelligence to solve practical problem of processing information and knowledge accumulated in the IT system and able to effectively use this method in the IT system.	T2A_U12 T2A_U15
K2INF_U08_S2PSI_U06	Able to design method of creation and updating the model of the user of IT system and design a personalised, smart, adaptive (web or mobile) user's interface.	T2A_U03 T2A_U17
K2INF_U08_S2PSI_U07	Able to properly select advanced method of computational intelligence to conduct implementation of methods of creation and updating the user's profile and/or interface personalisation strategy.	T2A_U12 T2A_U16
K2INF_U08_S2PSI_U08	Able to design a multi-agent system performing data processing and information integration.	T2A_U11 T2A_U17

K2INF_U08_S2PSI_U09	Able to plan and carry out standard and non-standard testing of usefulness of user's interface.	T2A_U03 T2A_U08 T2A_U15
K2INF_U08_S2PSI_U10	Able to apply analytical, simulative or experimental method for evaluation of a selected aspect of IT system based on advanced knowledge representation and processing methods.	T2A_U03 T2A_U04 T2A_U08 T2A_U09 T2A_U11

Appendix 6

Effects of education in major: computer science, 2nd degree, general academic
Specialization: Database Systems (SBD)

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
	KNOWLEDGE	
K2INF_W06_S2SBD_W01	Knowledge of development trends and the most important new achievements related to new database technologies	T2A_W03 T2A_W05
K2INF_W06_S2SBD_W02	Arranged, theoretically grounded general knowledge including key issues regarding implementation of advanced methods of implementation of database systems	T2A_W03 T2A_W07
K2INF_W06_S2SBD_W03	Arranged, theoretically grounded general knowledge including key issues regarding construction and mechanisms ensuring database security	T2A_W03 T2A_W07
K2INF_W06_S2SBD_W04	Arranged, theoretically grounded detailed knowledge of modeling of the real world and the methods of the deductive reasoning process	T2A_W03 T2A_W04 T2A_W05
K2INF_W06_S2SBD_W05	Arranged, theoretically grounded general knowledge including key knowledge with regard to implementation of data mining systems	T2A_W03 T2A_W07

SKILLS		
K2INF_U08_S2SBD_U01	Able to, in accordance with set specification including extra-technical aspects, design an advanced database system, implement this project using relevant methods, techniques and tools, including by adapting existing or preparing new tools for this purpose	T2A_U10 T2A_U17 T2A_U19
K2INF_U08_S2SBD_U02	Able to design implementation of advanced database systems, manage transactions, optimise inquiries and create indexes, adjust databases and evaluate aspects associated with efficiency of their implementation	T2A_U10 T2A_U14
K2INF_U08_S2SBD_U03	Able to design and assess advanced database systems to implement in specific organisations, institutions and companies	T2A_U15
K2INF_U08_S2SBD_U04	Able to identify hazards, analyse and solve problems related to security of database systems	T2A_U16 T2A_U17
K2INF_U08_S2SBD_U05	Able to use extended data models in advanced database systems and carry out experimental tests to formulate and efficiently solve simple research problems	T2A_U08 T2A_U09
K2INF_U08_S2SBD_U06	Able to apply methods of protection and provision of confidentiality of data in database systems in practice in accordance with the defined security policy	T2A_U18
K2INF_U08_S2SBD_U07	Able to , in accordance with set specification including extra-technical aspects, design a multimedia, interactive user's interface; able to implement this project using relevant advanced methods, techniques and tools, including by adapting existing or preparing new tools for this purpose	T2A_U10 T2A_U18 T2A_U19
K2INF_U08_S2SBD_U08	Able to carry out case study for any advanced database system	T2A_U05 T2A_U15
K2INF_U08_S2SBD_U09	Able to prepare and implement a complex, professional multimedia presentation, able to use information-communication techniques for implementation of tasks in team work	T2A_U04 T2A_U07 T2A_U19
K2INF_U08_S2SBD_U10	Able to use measures of effectiveness of data mining in advanced systems as well as analyse and interpret the obtained results	T2A_U08 T2A_U09

Effects of education in major: computer science, 2nd degree – general academic profile
Specialty - IT systems

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
KNOWLEDGE		
S2SI_W01	Extended and deepened knowledge of mathematics, physics or chemistry useful to formulate and solve complex problems in the scope of computer science	T2A_W01
S2SI_W02	Detailed knowledge with regard to study majors linked to computer science major	T2A_W02
S2SI_W03	Arranged, theoretically grounded key knowledge with regard to business modeling and specifications of requirements of IT systems	T2A_W03 T2A_W07
S2SI_W04	Arranged, theoretically grounded key knowledge with regard to implementation distributed IT systems	T2A_W03 T2A_W07
S2SI_W05	Arranged, theoretically grounded key knowledge with regard to advanced methods of data analysis	T2A_W03 T2A_W07
S2SI_W06	Arranged, detailed knowledge with regard to computer systems and up-to-date development trends of those systems	T2A_W03 T2A_W05
S2SI_W07	Knowledge of methodology of designing information systems and management of IT projects.	T2A_W03 T2A_W07
S2SI_W08	Knows methods of data integration and exchange in IT systems as well as methods and tools of integration of IT systems	T2A_W03 T2A_W07
S2SI_W09	Knowledge making it possible to design user's interactions with IT systems using advanced multimedia technologies.	T2A_W03 T2A_W07
S2SI_W10	Arranged, theoretically grounded knowledge with regard to collection, indexing and searching for new forms of information on the Internet, including indexing and searching for multimedia information on the basis of their content	T2A_W03 T2A_W04 T2A_W07
SKILLS		
S2SI_U01	Able to acquire information from literature, databases and other properly selected sources, also in English or other foreign language regarded as language of international communication in the field of study specialisation; able to integrate acquired information, interpret and critically assess it as well as draw conclusions and formulate and	T2A_U01

	exhaustively justify opinions	
S2SI_U02	Able to communicate using various techniques in the professional environment and in other environments, also in English or other foreign language regarded as language of international communication in the field of study specialisation	T2A_U02
S2SI_U03	Able to prepare a scientific study in Polish and a short scientific article in a foreign language regarded as the basic for science fields and scientific disciplines relevant for the study specialisation showing the author's own scientific research findings	T2A_U03
S2SI_U04	Language skills with regard to science fields and scientific disciplines relevant for the study specialisation, consistent with the requirements specified for level B2+ of the European Language Education Description System	T2A_U06
S2SI_U05	Able to - when formulating and solving the engineering tasks - integrate knowledge of science fields and scientific disciplines relevant for the study specialisation and use system approach, taking also account of extra-technical aspects	T2A_U10
S2SI_U06	Able to solve tasks involving creation of models, analyses and decision-making for various types of objects	T2A_U09 T2A_U11
S2SI_U07	Able to solve complex engineering task using advanced programming techniques	T2A_U18
S2SI_U08	Able to - in accordance with set specification including extra-technical aspects - design IT system implementing this project - at least in part - using relevant methods, techniques and tools, also by adapting existing or preparing new tools for this purpose	T2A_U10 T2A_U17 T2A_U19
S2SI_U09	Able to plan IT projects, manage them and evaluate their financial aspects	T2A_U10 T2A_U14
S2SI_U10	Able to assess and select IT systems to implement in specific organisations, institutions and companies	T2A_U15
S2SI_U11	Able to identify, analyse and solve legal aspects of information systems with regard to protection of industrial property and copyright; can benefit from patent information	T2A_U16 T2A_U17
S2SI_U12	Able to use analytical, simulative and experimental methods proper for artificial intelligence and knowledge engineering to formulate and solve simple research problems projects in the field of information and data mining systems	T2A_U08 T2A_U09
S2SI_U13	Able to apply methods of data integration exchange and methods and tools of integration of IT systems in practice; able to assess the usefulness and the possibility to use new accomplishments (techniques and technologies) in this respect	T2A_U18 T2P_U12
S2SI_U14	Able to - in accordance with set specification including extra-technical aspects - design multimedia, interactive communication with the user; able to implement this project at least in part - - using relevant methods, techniques and tools, adapting existing or preparing new tools for this purpose; able to assess the usefulness and the possibility to use new techniques and technology in this respect	T2A_U10 T2A_U18 T2A_U19 T2P_U12
S2SI_U15	Able to carry out case study for any information system	T2A_U05 T2A_U15

S2SI_U16	Able to design and implement a complex, professional multimedia presentation	T2A_U04 T2A_U07 T2A_U19
S2SI_U17	Able to use measures of effectiveness of data mining carry out analysis and interpret obtained results	T2A_U08 T2A_U09
	SOCIAL COMPETENCES	
S2SI_K01	Able to think and act in a creative and enterprising manner	T2A_K06
S2SI_K02	Aware of technical university graduate's social role, especially understands the need of formulation and communication of information and opinions concerning technological accomplishments and other aspects of engineering operations to the society, in particular using mass media; makes efforts to transfer such information and opinions in a commonly understandable manner along with justification of various points of view	T2A_K07

Appendix 8

Effects of education in major: computer science, 2nd degree, general academic
Specialization: Decision Support Systems (SWD)

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
	KNOWLEDGE	
K2INF_W06_S2SWD_W01	Well-established knowledge of IT decision support systems	T2A_W04 T2A_W05
K2INF_W06_S2SWD _W02	Basic knowledge of intelligent decision support systems, including adaptive and learning systems	T2A_W04 T2A_W05
K2INF_W06_S2SWD _W03	Broadened knowledge with regard to chosen methods of soft calculations, including methods based on fuzzy sets and sets using evolutionary approaches	T2A_W04 T2A_W05
K2INF_W06_S2SWD_W04	Broadened and well-established knowledge with regard to analysis of data and measurement results, including identification, recognition as well as machine learning	T2A_W04 T2A_W05
K2INF_W06_S2SWD_W05	Deepened knowledge with regard to analysis and designing of operation complex systems as well as decision-making, in particular control in computer systems	T2A_W02 T2A_W04 T2A_W05
	SKILLS	

K2INF_U08_S2SDW_U01	Able to implement simple decision-making algorithms and carry out their analytical and experimental evaluation	T2A_U09 T2A_U11 T2A_U15 T2A_U16 T2A_U18
K2INF_U08_S2SDW_U02	Able to design and activate a simple decision-making support system for various types of objects, including input-output objects and operation complex objects	T2A_U09 T2A_U10 T2A_U11 T2A_U16
K2INF_U08_S2SDW_U03	Able to analyse data and measurement results using specialist IT tools	T2A_U07 T2A_U08
K2INF_U08_S2SDW_U04	Able to assign and assess identification and recognition algorithms	T2A_U08 T2A_U15
K2INF_U08_S2SDW_U05	Able to design system controlling specified function of computer system	T2A_U09 T2A_U10
K2INF_U08_S2SDW_U06	Able to use modern methods and soft calculation algorithms in analysis and decision-making tasks	T2A_U07 T2A_U18
K2INF_U08_S2SDW_U07	Able to select and use modern methods of development of applications for implementation of decision support systems	T2A_U07 T2A_U12 T2A_U14 T2A_U15 T2A_U17 T2A_U19
K2INF_U08_S2SDW_U08	Ability to build distributed applications, combine applications operating in different environments and applications operating in mobile systems in the application to decision-making IT systems	T2A_U07 T2A_U12 T2A_U15 T2A_U17 T2A_U18
K2INF_U08_S2SDW_U09	Able to prepare documentation on project involving IT decision-making system completed by them in Polish and in English and present a relevant short oral presentation in English	T2A_U03 T2A_U04 T2A_U06

K2INF_U08_S2SDW_U10	Capable of self-education, for instance, expand their knowledge and skills concerning decision-making IT systems as well as able to specify directions of further learning	T2A_U05

Appendix 9

Effects of education in major: computer science, 2nd degree, general academic
Specialization: Data Communication (TEL)

Symbol	EFFECTS OF EDUCATION	Reference to effects of education for the field of technical sciences
KNOWLEDGE		
K2INF_W06_S2TEL_W01	Arranged, theoretically grounded knowledge with regard to signal transmission methods and techniques using various modulation techniques.	T2A_W02 T2A_W05
K2INF_W06_S2TEL_W02	Arranged, theoretically grounded knowledge with regard to methods and techniques of transmission of information in distributed data communication systems.	T2A_W05 T2A_W06
K2INF_W06_S2TEL_W03	Arranged, theoretically grounded knowledge with regard to methods of organisation and management of data communication traffic in distributed data communication systems.	T2A_W06 T2A_W07
K2INF_W06_S2TEL_W04	Arranged, theoretically grounded knowledge with regard to of quality data communication service supply methods in distributed data communication systems.	T2A_W03 T2A_W08
K2INF_W06_S2TEL_W05	Arranged, theoretically grounded knowledge with regard to provision of security and detection of security breaches in data communication services in distributed data communication systems.	T2A_W02 T2A_W09
SKILLS		
K2INF_U08_S2TEL_U01	Able to indicate differences and benefits from using analogue and digital data transmission techniques.	T2A_U07 T2A_U17
K2INF_U08_S2TEL_U02	Able to indicate differences and benefits resulting from using wire and wireless techniques of transmission of signals and able to indicate and prepare a concept of application wire and wireless techniques in basic Internet applications	T2A_U07 T2A_U08 T2A_U17
K2INF_U08_S2TEL	Able to define qualitative and quantitative requirements of the user of IT system related to data transmission	T2A_U07

_U03		T2A_U09 T2A_U18
K2INF_U08_S2TEL_U04	Able to indicate standards necessary to fulfil qualitative and quantitative requirements of the user of IT system related to data transmission	T2A_U07 T2A_U10
K2INF_U08_S2TEL_U05	Able to design data communication solutions necessary to fulfil qualitative and quantitative requirements of the user of IT system related to data transmission using the standards and the solutions available on the market	T2A_U07 T2A_U11 T2A_U17
K2INF_U08_S2TEL_U06	Able to assess the quality of services provided by data communication solutions necessary to fulfil qualitative and quantitative requirements of the user of IT system related to data transmission using the standards and the solutions available on the market	T2A_U07 T2A_U10 T2A_U12
K2INF_U08_S2TEL_U07	Able to assess and security of data communication services provided by data communication solutions necessary to fulfil qualitative and quantitative requirements of the user of IT system related to data transmission using the standards and the solutions available on the market	T2A_U07 T2A_U11 T2A_U13
K2INF_U08_S2TEL_U08	Able to estimate the costs of preparation and maintenance of data communication solutions necessary for the implementation of qualitative and quantitative requirements of the user of IT system	T2A_U07 T2A_U14 T2A_U18
K2INF_U08_S2TEL_U09	Able to prepare a concept of modernisation data communication solutions necessary for the implementation of qualitative and quantitative requirements of the user of IT system	T2A_U07 T2A_U15 T2A_U19
K2INF_U08_S2TEL_U10	Able to indicate differences and similarities in data communication solutions in the applications of the Internet in household networks, personal networks, vehicle networks, e-health, e-administration and e-education networks, real time systems, etc..	T2A_U07 T2A_U16 T2A_U19