UNIVERSITY OF DEBRECEN, FACULTY OF INFORMATICS

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BUSINESS INFORMATICS MSC

2025

Mode: Full-time training

Program Coordinator: Dr. József Mihály Gáll (gall.jozsef@inf.unideb.hu)

Mentor: Dr. Anett Rácz (racz.anett@inf.unideb.hu)

Qualification requirements

General requirements of the diploma are regulated by The Rules and Regulations of The University of Debrecen.

Work and Fire Safety and Physical Education

The courses of „Work and Fire Safety" and „Physical Education" are worth 1 - 1 credit, which must be completed in excess of the number of credits required for the diploma as specified in the training and outcome requirements of the degree.

Diploma credit requirements:

Natural Science and Economic:		20 credits
Business Informatics Knowledge:		24 credits
Special subjects:		40 credits
Compulsory topics:	28 credits	
Optional topics:	12 credits	
Professional Training:	9 credits	
Thesis work:		30 credits
Free choice:		6 credits
Total		**120 credits**
Work and Fire Safety Training:		1 credit
Physical Education (1 semester):		1 credit

Professional training/Internship requirements

Professional training is a practice which is completed at a competent training place. It lasts for at least 6 weeks and 240 work hours.

It is a must to complete Professional training subject to issue the absolutorium (pre-degree certificate).

https://inf.unideb.hu/en/professional-training

Student can apply for Professional training after completing at least one semester.

Faculty of Informatics annex to the Academic and Examination Rules and Regulations of the University of Debrecen contains the procedure of the professional training.

The Thesis

During the studies, Student must write a thesis. Writing a thesis is a diploma requirement.

Thesis subject is mandatory to complete. The prerequisites to register for the Thesis subject are the followings:

- chose a thesis topic by the deadline.
  (Together with the supervisor the candidate writes a work plan in the maximum of two pages. The work plan describes the aim of the work, areas of expertise and the scheduling of the work.)
- the chosen topic is approved by the Educational Committee
- at least 30 completed credits.

Final Exam / State Exam

a., Requirements for Final Exam

1. Complete all the 120 credits required by the curriculum of program specialisation to have the degree of MSc program
2. Carry out the internship
3. Write and submit the Diploma Thesis

b., Process of the Final Exam

The Final Exam consists of an oral part only and the purpose is to examine the coherence of the professional knowledge.

F. The average from the grades of the oral exam (rounded to a whole number) consists of an "A" and "B" item of the following topics: Natural Science and Economic Knowledge, Business Informatics Knowledge, Special Knowledge. If the grade for any item is failed, the grade is failed, and the final examination is failed.

D1. Thesis defence. During the defence the candidate has to sum up the Thesis in a short presentation then s/he answers the questions from the referee of the Thesis and the members of the Committee.

D2. The grade for the thesis, which is determined by the Final Examination Committee taking into account the grade proposed by the thesis assessor.

Calculation of the final examination grade (**ZV**): ZV = (F+D1+D2)/3

If the grade D2 is failed, the candidate will not be allowed to sit the final examination.

If any of the grades of F or D1 are unsatisfactory, the final exam is also unsatisfactory. Only the component graded as unsatisfactory must be retaken in the retake of the final examination.

Grade of Diploma:

Diploma grade: in the case of a successful final examination, it is determined based on the average of the following results:

a) **SZ**: Average of the grades for the Thesis subject, the grade for the thesis assessment and the grades for the thesis defence in the final examination, rounded to two decimal places.

b) **F**: Average of the grades obtained in the final examination, rounded to a whole number.

c) **T**: the credit-weighted average of all compulsory and optional professional subjects completed during the course, except for 'Thesis 1' and 'Thesis 2', rounded to two decimal places.

Diploma grade = (0,3*SZ+0,2*F+0,5*T)

Based on the above average result, the qualification of the diploma is determined by the University of Debrecen's Academic and Examination Regulations, Section 31 (7).

The diploma shall be assessed based on the calculation of the grade average as follows:

outstanding	4,81-5,00
excellent	4,51-4,80
good	3,51-4,50
satisfactory	2,51-3,50
pass	2,00-2,50

Natural Science and Economic – needed 20 credits

Code	Subject name	Credit	Type and number			Assessment	Prerequisites	Period	Semester
			lec.	practice					
				sem.	lab				
INMGA0101-17 INMGA0101E INMGA0101L	Advanced methodology	6	2		2	E S			1
INMGA0102-17 INMGA0102E	Managerial economics	3	2			E			1
INMGA0207-17 INMGA0207L	Artificial Intelligence in planning and decisionmaking	3			2	PM			2
INMGA0208-17 INMGA0208E INMGA0208G	Managerial Accounting and Controlling	4	1	2		PM			2
INMGA0416-17 INMGA0416E INMGA0416G	Marketing Management	4	1	2		PM			4

Business Informatics Knowledge – needed 24 credits

Code	Subject name	Credit	Type and number			Assessment	Prerequisites	Period	Semester
			lec.	practice					
				sem.	lab				
INMGA0209-17 INMGA0209E	IT service management	3	2			E			2
INMGA0210-17 INMGA0210L	Software engineering and software development	6			4	PM			2
INMGA0211-17 INMGA0211E INMGA0211L	Enterprise architecture	6	2		2	E S			2
INMGA0212-17 INMGA0212E	Supply chains and value production management	3	2			E			2
INMGA0314-17 INMGA0314L	Web content management	3			2	PM			3
INMGA0417-17 INMGA0417E	Software Engineering Principles	3	2			E	INMGA0210-17		4

Special subjects, Compulsory topics – needed 28 credits

Code	Subject name	Cre-dit	Type and number			Asses-ment	Prerequisites	Period	Semes-ter
			lec.	practice					
				sem.	lab				
INMGA0103-17 INMGA0103E INMGA0103G	Models of modern finance	6	2	2		PM			1
INMGA0104-17 INMGA0104L	Programming of the SAP enterprise resource planning system (ABAP	3			2	PM			1
INMGA0105-17 INMGA0105E INMGA0105L	Machine learning for business informatics	4	1		2	PM			1
INMGA0106-17 INMGA0106L	Data preparation	3			2	PM			1
INMGA0213-17 INMGA0213L	SAP system administration	3			2	PM			2
INMGA0315-17 INMGA0315E INMGA0315L	Data mining	6	2		2	E S			3
INMGA0418-17 INMGA0418E	Global Corporate Strategies	3	2			E			4

Special subjects, Optional topics – needed 12 credits

Code	Subject name	Cre-dit	Type and number			Asses-ment	Prerequisites	Period	Semes-ter
			lec.	practice					
				sem.	lab				
INMGA9921-17 INMGA9921L	Knowledge of programming	3			2	PM			1
INMGA9922-17 INMGA9922E	Corporate Security	3	2			E			2
INMGA9923-17 INMGA9923L	Modelling of database systems	3			2	PM			2
INMGA9924-17 INMGA9924E INMGA9924G	International Management	6	2	2		E S			3
INMGA9925-17 INMGA9925L	Applied Analytics	3			2	PM	INMGM0106-17		3
INMGA9926-17 INMGA9926L	Computational optimization	3			2	PM	INMGM0101-17		3
INMGA9927-17 INMGA9927L	Financial mathematical models	3			2	PM			3
INMGA9997-21 INMGA9997G	Professional Training	9				PM			3
INMGA9928-17 INMGA9928G	Information market economics	3		2		PM			4
INMGA9929-17 INMGA9929E	Business law	3	2			E			4
INMGA9930-17 INMGA9930L	Advanced data visualization	3			2	PM			4

Thesis work – needed 30 credits

Code	Subject name	Credit	Type and number			Assessment	Prerequisites	Period	Semester
			lec.	practice					
				sem.	lab				
INMGA0319-17 INMGA0319L	Thesis 1	15			10	PM			3
INMGA0420-17 INMGA0420L	Thesis 2	15			10	PM			4

Free choice – needed 6 credits

Code	Subject name	Credit	Type and number			Assessment	Prerequisites	Period	Semester
			lec.	practice					
				sem.	lab				

* "Free choice" - Professional electives offered by the Faculty of Informatics and institutional electives offered by other faculties of the University of Debrecen.

Work and Fire Safety and Physical Education – needed 2 credits

must be completed in excess of the number of credits required
for the diploma as specified in the training and outcome requirements of the degree

Code	Subject name	Credit	Type and number			Assessment	Prerequisites	Period	Semester
			lec.	practice					
				sem.	lab				
	Work and Fire Safety	1				PM			1
	Physical Education	1				PM			

Exam types:
E exam
S signature
PM practical mark

BUSINESS INFORMATICS MSC

Description of Subjects

Natural Science and Economic

ADVANCED METHODOLOGY

INMGA0101-17

Semester:	1
Type:	Lecture / Laboratory
Number of Classes:	2+0+2
Credit:	6
Status:	Obligatory
Assessment:	Exam
Prerequisites:	None
Responsible:	Dr. István Fazekas

Topics:
Differentiation of functions of several variables. Taylor's expansion of functions of several variables. Unconstrained and constrained extrema. Optimization: gradient method, quasi Newton method. Optimization problems. Multiple integrals. Applications of multiple integrals. Multidimensional random variables. The multivariate normal distribution. Principal component analysis. Factor analysis. Cluster analysis. Discriminant analysis. Logistic regression. Basic problems of time series analysis, additive and multiplicative models, seasonality and cyclicity. ARIMA processes, Box-Jenkins analysis, stationarity, smoothing.

Compulsory/Recommended Readings:

- Sydsaeter K., Hammond, P.: Mathematics for Economic Analysis. Prentice Hall, 1995, ISBN-10: 013583600X
- J. Nocedal, S. J. Wright: Numerical Optimization. Springer, 2006. ISBN-10: 0-387-30303-0
- Maddala, G. S.: Introduction to econometrics. Wiley, 2001, ISBN: 0471497282
- Hamilton, J. D.: Time series analysis. Princeton, 1994, ISBN-10: 0691042896
- K. V. Mardia; J. T. Kent; J. M. Bibby: Multivariate Analysis. Academic Press, 1979. ISBN 0-12-471252-5

MANAGERIAL ECONOMICS

INMGA0102-17

Semester: 1
Type: Lecture
Number of Classes: 2+0+0
Credit: 3
Status: Obligatory
Assessment: Exam
Prerequisites: None
Responsible: Dr. Levente Sándor Nádasi

Topics:
To make students familiar with the fundamental notions and methods required to managerial decision-making, in order to make students able to reach better decisions about costs, prices, profit and strategies.

Compulsory/Recommended Readings:
- Baye, Michael: Managerial Economics and Business Strategy. Seventh Edition. Boston: McGraw-Hill Irwin, 2010.
- Mankiw, N. G.: Principles of Economics. Third edition. Thomson, 2004.
- Milgrom, P. – Roberts, P.: Economics, Organization and Management. Pearson 1992.

ARTIFICIAL INTELLIGENCE IN PLANNING AND DECISION-MAKING

INMGA0207-17

Semester: 2
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Balázs Harangi

Topics:
Tools for describing and solving planning problems, scheduling problems, probabilistic reasoning, Bayes networks, fuzzy sets, decision trees, decision-theoretic expert systems, game-theory.

Compulsory/Recommended Readings:
- S. Russell, P. Norvig: Artificial Intelligence: A Modern Approach, Pearson (3rd Edition), 2009.
- Malik Ghallab, Dana Nau and Paolo Traverso: Automated Planning and Acting, Cambridge University Press, 2016.

MANAGERIAL ACCOUNTING AND CONTROLLING

INMGA0208-17

Semester: 2
Type: Lecture / Seminar
Number of Classes: 1+2+0
Credit: 4
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Veronika Fenyves

Topics:
Accounting for management, Cost classification, Accounting for labour, Absorption and mar-ginal costing, Job, batch and process costing, Budgeting, Standard costing, The nature of man-agement control systems, Responsibility centres, Revenue and expense centres, Profit centres, Transfer pricing, Measuring and controlling assets employed, Strategic planning, Analysing financial performance, Performance measurement.

Compulsory/Recommended Readings:

- R., N. Anthony - V. Govindarajan: Management Control Systems, McGraw-Hill/Irwin, 12th Edition, New York, 2007.
- Merchant, K.-Van der Stede, W.: Management Control Systems, Performance Measurement, Evaluation and Incentives, Prentice Hall, 2007.
- Warren, C. - Reeve, J. – Duchac, J.: Financial & Managerial Accounting. Cengage Learning. 13th Edition, 2015.
- Maher, M. – Stickney, C. – Weil, R.: Managerial Accounting: An Introduction to Concepts. Methods and Uses. Cengage Learning. 11th Edition, 2011.

MARKETING MANAGEMENT

INMGA0416-17

Semester: 4
Type: Lecture / Seminar
Number of Classes: 1+2+0
Credit: 4
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Marietta Kiss

Topics:
The aim of this course is to make students able to apply their previously gained marketing knowledge in solving business problems. Beside the new topics, the course aims to deepen the marketing knowledge students already have, via lectures and seminars, including a marketing simulation game. The course includes the following topics: Introduction to Marketing Management; Developing Marketing Strategies and Plans, Analysis and Strategies of Competitors; Customer Value, Satisfaction, and Loyalty; Special Marketing Management Areas: Services Marketing and International Marketing; Managing a Holistic Marketing Organization.

Compulsory/Recommended Readings:

- KOTLER, P.–ARMSTONG, G. (2016): Principles of Marketing with MyMarketingLab: Global Edition, 16/E, Pearson, ISBN-10: 1292092599, ISBN-13: 9781292092591
- KOTLER, P.–KELLER, K. L.–BRADY, M.–GOODMAN, M.–HANSEN, T. (2009): Marketing Management. First edition, Pearson/Prentice Hall, Harlow, ISBN: 9780273718567
- MASON, C. H.–PERRAULT, W. D. (2002): The Marketing Game! 3rd Edition. McGraw-Hill Higher Education, New York (USA), ISBN-13: 978-0072513806, ISBN-10: 0073897345

IT SERVICE MANAGEMENT

INMGA0209-17

Semester: 2
Type: Lecture
Number of Classes: 2+0+0
Credit: 3
Status: Obligatory
Assessment: Exam
Prerequisites: None
Responsible: Dr. Anikó Szilvia Vágner

Topics:
Introduction and usage of basic concepts of the IT service management, Service strategy, Service design, Service transition, Service operation, Continual service improvement, Case studies.

Compulsory/Recommended Readings:
- Steinberg: Implementing ITSM, Trafford Publishing, 2014
- Orand, Villarreal: Foundations of IT Service Management with ITIL 2011: ITIL Foundations Course in a Book, CreateSpace Independent Publishing Platform, 2011
- ITIL For Beginners: The Complete Beginner's Guide To ITIL, ClydeBank Media LLC, 2015
- Steinberg: Architecting ITSM: A Reference of Configuration Items and Building Blocks for a Comprehensive IT Service Management Infrastructure, Trafford, 2014

SOFTWARE ENGINEERING AND SOFTWARE DEVELOPMENT

INMGA0210-17

Semester: 2
Type: Laboratory
Number of Classes: 0+0+4
Credit: 6
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Piroska Biró

Topics:
By this class the students are introduced to the business analysis, requirement engineering and software development methodologies. The students will know their place in the system development process and will be able to contribute in them. They will understand the methods and will be able to apply them.

Compulsory/Recommended Readings:
- Ian Sommerville: Software Engineering (10th Edition), Pearson, 2015.
- Klaus Pohl, Chris Rupp: Requirements Engineering Fundamentals, Rocky Nook Inc. 2015.
- International Institute of Business Analysis, A Guide to the Business Analysis Body of Knowledge® (BABOK® Guide) Version 3.0, 2015.

ENTERPRISE ARCHITECTURE

INMGA0211-17

Semester: 2
Type: Lecture / Laboratory
Number of Classes: 2+0+2
Credit: 6
Status: Obligatory
Assessment: Exam
Prerequisites: None
Responsible: Dr. Anikó Szilvia Vágner

Topics:
Introduction to basics of enterprise architecture: enterprise strategy, products, enterprise goals. Architectural setup of different type and sized enterprises. Study of small and midsized company strategy and growth from enterprise IT architecture perspective. Study of production company strategy, structure, operation from enterprise architecture perspective. Study of service company strategy, structure, operation from enterprise architecture perspective.

Compulsory/Recommended Readings:
- James McGovern, Scott W. Ambler, Michael A. Stevens, James Linn, Vikas Sharan, Elias K. Jo: Practical Guide to Enterprise Architecture, 2004.

SUPPLY CHAINS AND VALUE PRODUCTION MANAGEMENT

INMGA0212-17

Semester: 2
Type: Lecture
Number of Classes: 2+0+0
Credit: 3
Status: Obligatory
Assessment: Exam
Prerequisites: None
Responsible: Dr. Judit Oláh

Topics:
The course goals are to teach students how to make the production and companies more success-ful with the efficient production and process management, are able to analyse processes, famil-iarize themselves with the methods of purchasing, distribution, forecasting, inventory optimisa-tion, and sales planning, resource planning, lean system.

Compulsory/Recommended Readings:
- Russell, R. S., B. W. Taylor: Operations Management, 7th Edition, Wiley & Suns, INC., ISBN: 978-0-470-64623-6, 2011
- Wisner J. D.: Principles of Supply Chain Management. Cengage Learning. ISBN: 978-1-285-42831-4, 2016.

WEB CONTENT MANAGEMENT

INMGA0314-17

Semester: 3
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Anett Rácz

Topics:
Structure and overview of WCMS. Introduction into working with WCMS (local environment, install, initial settings). Structure of Back End / Administrator site. Language settings, multi language sites, managing extensions, templates. User administration, user groups, authorizations, roles. Modules. Introduction into CSS. Overview of PHP based dynamic sites, inserting user developed scripts. Fundamentals of SEO. Google Analytics - inserting tracking codes for visitors, events, etc. Registration of the website, making reports, real time overview of statistics, developing event tracking scripts, techniques for analysis.

Compulsory/Recommended Readings:

- Jason Mc Donald: SEO Fitness Workbook: 2017 Edition.
- Stephen Burge: Joomla! 3 Explained: Your Step-by-Step Guide 2014.

SOFTWARE ENGINEERING PRINCIPLES

INMGA0417-17

Semester:	4
Type:	Lecture
Number of Classes:	2+0+0
Credit:	3
Status:	Obligatory
Assessment:	Exam
Prerequisites:	INMGA0210-17 (Software engineering and software development)
Responsible:	Dr. Attila Tamás Adamkó

Topics:
Introducing students into the advanced part of Software Engineering aspects. Highlighting principles, methods and standards that are widely used in the industry.

Compulsory/Recommended Readings:
- Sommerville: Software Engineering, Addison Wesley, 2007.
- Rozanski, N., Woods E., Software Systems Architecture: Working With Stakeholders Using Viewpoints and Perspectives, Addison Wesley, 2005.
- Rumbaugh J., Jacobson I., Booch G., Unified Modeling Language Reference Manual, The 2nd Edition, Addison Wesley, 2004.
- Evans, E., Domain-Driven Design: Tackling Complexity in the Heart of Software, Addison Wesley, 20036.

Special subjects, Compulsory Topics

MODELS OF MODERN FINANCE

INMGA0103-17

Semester:	1
Type:	Lecture / Seminar
Number of Classes:	2+2+0
Credit:	6
Status:	Obligatory
Assessment:	Practical mark
Prerequisites:	None
Responsible:	Dr. József Mihály Gáll

Topics:
The course presents the main results of capital market models, including the Markowitz model, CAPM, the risk measures and the notion and pricing of financial derivatives.

Compulsory/Recommended Readings:
- Brealey R. and Myers S.: Principles of Corporate Finance, 11th Global Edition, McGraw-Hill, 2013.
- Hull, J. C.: Options, Futures and Other Derivatives, 10th edition, Pearson, 2018.
- Barucci, E., Fontana, C.: Financial Markets Theory, 2nd ed., Springer, 2017.

PROGRAMMING OF THE SAP ENTERPRISE RESOURCE PLANNING SYSTEM (ABAP)

INMGA0104-17

Semester: 1
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Piroska Biró

Topics:
Introduction into the ABAP programming language, developing program codes in SAP environment. First usage of the environment, developing the first ABAP program. Structure of an ABAP program, types, literals, expressions, declaration, variable, constant, parameter, assignment statement. Selection control structures, loop control structures, messages, writing to the output window. Structures, internal tables. Internal tables, ABAP subprograms, passing parameter. Screens and events, ABAP Dictionary, using database tables. Statements of OpenSQL, transaction handling. Memory management. Creating, modifying, joining screens.

Compulsory/Recommended Readings:
- Moxon, P.: Beginner's Guide to SAP ABAP. SAPPROUK, 2012.
- Horst Keller: The Official ABAP Reference, Galileo Press, 2012.

MACHINE LEARNING FOR BUSINESS INFORMATICS

INMGA0105-17

Semester: 1
Type: Lecture / Laboratory
Number of Classes: 1+0+2
Credit: 4
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. István Fazekas

Topics:
The scope of problems that can be solved by neural networks. Main types of neural networks. Structure and training of the multilayer perceptron (MLP). Activation functions, loss functions. Training MLP: error back-propagation and its versions. Applications of MLP. Radial-basis function networks (RBF). Penalty functions, regularization. Generalized radial-basis function networks. Kernel function methods. Applications. The problem and methods of deep learning. The autoencoder and its applications. Support vector machines (SVM) for separation. SVM for approximation. Applications. The structure of the convolutional network. Applications of convolutional networks. Recurrent networks. Applications of recurrent networks.

Compulsory/Recommended Readings:
- Haykin, S.: Neural Networks. A Comprehensive Foundation. Prentice hall. New Jersey, 1999. ISBN 0-13-273350-1
- Ian Goodfellow and Yoshua Bengio and Aaron Courville: Deep Learning. MIT Press, 2016.

DATA PREPARATION

INMGA0106-17

Semester: 1
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Patricia Ágnes Szokol

Topics:
The aim is to acquire methods of preparation of databases which are useful for analysis, and for studying databases from a statistical point of view. Advanced queries: Recoding, CASE logic. Advanced queries: Grouping and summarizing data. Basic functions, filtering based on aggregate functions, formats. Specific functions and formats. Effective queries: Joining tables, transposing and data manipulation. Effective queries: Sorting and ranking. Random sampling. Best practices of data preparation. Detecting and handling extreme/missing values I. Transformations of data sets. Creating and editing prompts. Prompts in a project.

Compulsory/Recommended Readings:
- Gerhard Svolba: Data Preparation for Analytics Using SAS, SAS Institute Inc., 2006, ISBN 978-1-59994-047-2.
- Susan J. Slaughter, Lora D. Delwiche: The Little SAS Enterprise Guide Book, SAS Institute Inc., 2017, ISBN 978-1-62960-380-3.

SAP SYSTEM ADMINISTRATION

INMGA0213-17

Semester: 2
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Obligatory
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Anett Rácz

Topics:
SAP solutions for different companies. Initialization of the system (set up client, starting and stopping the system, sign in, etc.). Licencing. User management. Messages (Personalised user messages, system messages, pop-up messages). Roles, authorization, user profiles, user monitoring. Fundamentals of system configuration parameters. Setting up operation modes. Background processing. Backup and restore. Organizing administrator tasks, overview of transaction codes, documentation and planning.

Compulsory/Recommended Readings:
- Rácz A., SAP System administration, Gyires Béla Tananyagtár, TÁMOP-4.1.1.C-12/1/KONV2012-0013 (2015).
- Schreckenbach, S. (2014). Practical Guide - SAP Administration. Boston: Galileo Press.

DATA MINING

INMGA0315-17

Semester: 3
Type: Lecture / Laboratory
Number of Classes: 2+0+2
Credit: 6
Status: Obligatory
Assessment: Exam
Prerequisites: None
Responsible: Dr. László Szathmáry

Topics:
Definition of data mining and its role in the KDD process. Basic data mining tasks and techniques, the most important challenges. Datatypes, attributes, measuring scales, types of datasets. Issues of data quality, preprocessing. Explorative data analysis: statistics and graphical tools. Supervised learning: decision trees, regression, rule-based, nearest neighbour, Bayes classifiers, artificial neural networks (ANN), support vector machines (SVM), ensemble methods (bagging, boosting). Market basket analysis. Distance and similarity. Clustering. K-means clustering and its variants. Hierarchical clustering. Density based methods: DBSCAN. Performance metrics and evaluation. Anomaly detection. Web-mining. Applications: direct marketing, sentiment analysis, churn analysis, risk analysis.

Compulsory/Recommended Readings:
- Pang-Nin Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining. Pearson / Addison Wesley 2006. ISBN 0-321-32136-7
- Jiawei Han, Micheline Kamber: Data Mining: Concepts and Techniques. Elsevier 2006. ISBN 13: 978-1-55860-901-3

GLOBAL CORPORATE STRATEGIES

INMGA0418-17

Semester: 4
Type: Lecture
Number of Classes: 2+0+0
Credit: 3
Status: Obligatory
Assessment: Exam
Prerequisites: None
Responsible: Dr. Tünde Riskó, Dr. Csapóné

Topics:
The course is designed to introduce students to the particularities of global corporate strategies both theoretically and in practice. A broad overview over the most relevant topics in the area of global corporate strategies is given.

Compulsory/Recommended Readings:
- MORSCHETT, DIRK; SCHRAMM-KLEIN, HANNA; ZENTES, JOACHIM (2010): Strategic International Management – Text and Cases, 2nd ed., Gabler: Wiesbaden, ISBN: 978-3-8349-2535-0.

Special subjects, Optional topics

KNOWLEDGE OF PROGRAMMING

INMGA9921-17

Semester: 1
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Optional
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Piroska Biró

Topics:
Detailed discussion of an object-oriented programming language. Introduction (Basic concepts of object-oriented paradigm. Class, object, instantiation.). Inheritance, class hierarchy. Polymorphism, method overloading. Scoping. Information hiding, accessibility levels. Abstract classes and interfaces. Programming language elements of object-oriented languages: character set, lexical units, expressions, statements. The type system of object-oriented languages. Members of types: fields, (named) constants, properties, methods, events, operators, indexers, constructors, destructors, embedded types. Interfaces. Collections. Functional language elements. Lambda expressions. Handling data streams. Exception handling. I/O, file handling. Persistence data management: relational database, XML, JSON. User Interfaces.

Compulsory/Recommended Readings:
- Y. Daniel Liang: Introduction to Java Programming, 10th edition, Pearson, 2014.
- Herbert Schildt , Introducing JavaFX 8 Programming (Oracle Press), McGraw-Hill Education; 1 edition (June 30, 2015).
- Christian Bauer, Gavin King: Java Persistence with Hibernate, Manning Publications, 2015.

CORPORATE SECURITY

INMGA9922-17

Semester: 2
Type: Lecture
Number of Classes: 2+0+0
Credit: 3
Status: Optional
Assessment: Exam
Prerequisites: None
Responsible: Dr. Andrea Pintér-Huszti

Topics:
Basic concepts, attacks, encryption schemes. Asymmetric algorithms: DLP, DH key exchange, ElGamal encryption. Elliptic curve arithmetic, ECDLP. Elliptic curve encryption. Digital signa-tures: DSA, ECDSA. Corporate security: Entity authentication, biometric, smartcard based au-thentication (eID, ePass, eSign), Access control (DAC, MAC, RBAC, ABAC), Database security, SQLi attacks and countermeasures, database encryption. Cloud security, E-commerce security, SSL-based e-payment system, SET, Bitcoin.

Compulsory/Recommended Readings:
- William Stallings: Computer Security Principles and Practice, 3. edition, Pearson, 2015, ISBN-13 978-0133773927, ISBN-10 0133773922.
- Andreas Enge: Elliptic curves and their applications to Cryptography, An introduction, 2001, Kluwer Academic Publishers.

MODELLING OF DATABASE SYSTEMS

INMGA9923-17

Semester: 2
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Optional
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Anikó Szilvia Vágner

Topics:
Abstract modelling of database systems, Modelling relational databases, Design Entity-Relationship model, Design Enhanced Entity-Relationship model, Transform ER and EER models into relational model, OR models, UML data models, Data warehouse models, NoSQL models.

Compulsory/Recommended Readings:
- Ramez Elmasri, Shamkant B. Navathe: Fundamentals of Database Systems (7th Edition), Pearson, 2015.
- Connolly, Begg: Database Systems: A Practical Approach to Design, Implementation, and Management, Pearson; 2014.

INTERNATIONAL MANAGEMENT

INMGA9924-17

Semester: 3
Type: Lecture / Seminar
Number of Classes: 2+2+0
Credit: 6
Status: Optional
Assessment: Exam
Prerequisites: None
Responsible: Dr. Tünde Riskó, Dr. Csapóné

Topics:
International Management explores the manager's role within the dynamic global environment of business management by exploring the political, legal, technological, competitive, and cultural factors that shape corporations worldwide.

Compulsory/Recommended Readings:
- Deresky, Helen [2016] (2017): International Management – Managing Across Borders and Cultures – Texts and Cases, 9th (Global) Edition, Pearson. ISBN 13: 978-1-292-15353-7

APPLIED ANALYTICS

INMGA9925-17

Semester: 3
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Optional
Assessment: Practical mark
Prerequisites: INMGA0106-17 (Data preparation)
Responsible: Dr. Patrícia Ágnes Szokol

Topics:
The aim is to learn methods to solve complex problems on data mining. Introduction to SAS Enterprise Miner. Data mining case study: Customer segmentation. Data mining case study: Web site usage associations. Data mining case study: Credit risk. Data preparation: Data transformations. Data preparation: Managing extreme/missing values, filtering. Data preparation: Sampling, data partitioning. Pattern discovery: Clustering and examining profiles. Pattern discovery: Market basket analysis. Predictive modelling: Decision predictions (fraud detection), Predictive modelling: Estimate predictions (the amount of fraud).

Compulsory/Recommended Readings:
- Kattamuri S. Sarma: Predictive Modeling with SAS Enterprise Miner: Practical Solutions for Business Applications, Second Edition, SAS Institute Inc., 2013, ISBN 978-1-60764-767-6.
- Barry de Ville, Padraic Neville: Decision Trees for Analytics Using SAS Enterprise Miner, SAS Institute Inc., 2013, ISBN 978-1-61290-315-6.
- Bart Baesens: Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, John Wiley Sons Inc., 2014, ISBN 978-1-118-89270-1.
- Olivia Parr-Rud: Business Analytics Using SAS Enterprise Guide and SAS Enterprise Miner: A Beginner's Guide, SAS Institute Inc., 2014, ISBN 978-1-61290-783-3

COMPUTATIONAL OPTIMIZATION

INMGA9926-17

Semester: 3
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Optional
Assessment: Practical mark
Prerequisites: INMGA0101-17 (Advanced methodology)
Responsible: Dr. Anett Rácz

Topics:
Fundamentals of Linear Programming and mathematical modelling. Special modelling techniques (if-then, either-or constraints, fixed cost, etc.). Mathematical Programming Language and MPS format. Overview of optimization solvers. Different types of inputs (in AIMMS or CPLEX software). Solving elementary LP models and creating reports. Sensitivity analysis with software. Modelling and solving Network Problems. Piecewise linear programming problems. Solving and analysing models with big input data. Callable Library of CPLEX or AIMSS optimization solvers.

Compulsory/Recommended Readings:
- Axel Buecker, Yana Ageeva, Veronique Blanchard, Dr. Jeremy Bloom, Dr. Mehmet F. Candas, Joao Chaves, Guang Feng, Abhishek Raman, Dr. Hans Schlenker: Optimization and Decision Support Design Guide, IBM PRESS 2012.
- Stephen Sashihara: The Optimization Edge: Reinventing Decision Making to Maximize All Your Company's Assets, 2011, ISBN 978-0-07-174657-1
- Johannes Bisschop: „AIMMS Optimization Modeling", AIMMS, 2017.
- Panos M. Pardalos and Mauricio G. C. Resende, Handbook of Applied Optimization, Oxford University Press, 2002

FINANCIAL MATHEMATICAL MODELS

INMGA9927-17

Semester: 3
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Optional
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Erika Fülöp

Topics:
During the course the students get acquainted with some models of financial mathematics for derivatives pricing and risk management together with related fitting, statistical, financial methods and tests, which they will test and analyse in empirical problems.

Compulsory/Recommended Readings:
- Hull, J. C.: Options, Futures and Other Derivatives, 10th edition, Pearson, 2018.
- Musiela, M. and Rutkowski, M.: Martingale Methods in Financial Modelling, Ed. 2, Springer, 2005.
- Barucci, E., Fontana, C.: Financial Markets Theory, 2nd ed., Springer, 2017.
- Brealey R. and Myers S.: Principles of Corporate Finance, 11th Global Edition, McGraw-Hill, 2013.
- Glasserman, P.: Monte Carlo Methods in Financial Engineering, Springer, 2003.

INFORMATION MARKET ECONOMICS

INMGA9928-17

Semester: 4
Type: Seminar
Number of Classes: 0+2+0
Credit: 3
Status: Optional
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. István Kovács

Topics:
Giving practical knowledge about navigating business in a digital economic environment. Introducing students to the models of information industries through case studies and advanced practical analysis.

Compulsory/Recommended Readings:
- Varian, H. R. - Shapiro, C. (1999): Information Rules: A Strategic Guide to the Network Economy. Harvard Business Press.
- Archibugi, Daniele and Lundvall, Bengt-Åke (2002): The Globalizing Learning Economy Oxford University Press.

BUSINESS LAW

INMGA9929-17

Semester: 4
Type: Lecture
Number of Classes: 2+0+0
Credit: 3
Status: Optional
Assessment: Exam
Prerequisites: None
Responsible: Dr. Géza Károlyi

Topics:
The course is aimed at making students familiar with the basics of Private Law. The main topics are: contracts in civil law and their conditions, form and content requirements, types and conse-quences of breach of contract.

Compulsory/Recommended Readings:
- Joanne Banker Hames – Yvonne Ekern: Introduction to Law. Chapter 7., 10., 12.. Pearson. ISBN-13.978-0-13-502434-8
- Ewan Macintyre: Business Law. Pearson Education Limited. ISBN: 978-1-4082-3797-7.

ADVANCED DATA VISUALIZATION

INMGA9930-17

Semester: 4
Type: Laboratory
Number of Classes: 0+0+2
Credit: 3
Status: Optional
Assessment: Practical mark
Prerequisites: None
Responsible: Dr. Kinga Tünde Kruppa

Topics:
The process of data visualization, its types and realization. Getting to know the different types of data sources (XML, Excel, JSON, CSV, etc.). Visualization of quantitative data. Types of visual analysis. Visualization in the cloud. Reporting systems, creating dashboards (planning, realization) meeting the needs of clients. Current promising trends in information visualization. Proficiency in usage of at least one market leading visualization tool.

Compulsory/Recommended Readings:
- Few, Stephen: Now You See It: Simple Visualization Techniques for Quantitative Analysis, Analytics Press, 2009, ISBN: 978 0970601988
- Börner, Katy & Polley, David E.: Visual Insights: A Practical guide to Making Sense of Data, MIT, 2014, ISBN: 978-0262526197.
- Munzner, Tamara: Visualization Analysis and Design, A K Peters/CRC Press, 2014, ISBN: 978-1466508910
- Tufte, Edward R.: The Visual Display of Quantitative Information (2nd Edition), Graphics Pr, 2001, ISBN: 978-0961392147.