Advance Computer Networks					
Course Code CCS80231	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2	**Frequency** Each even-semester	**Duration** 16 meetings

1	**Types of courses** Elective	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand the structure and concept of internet routing. Students are able to understand and apply routing protocols (OSPF and BGP). Students are able to identify and provide simple analysis in computer network problems.
5	**Teaching methods** Lectures, case study, class discussion, presentation
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information**

	1. Kurose & Ross. 2012. *Computer Networking: Top down Approach.* 6th Ed., Pearson/Addison. 2. Hartpence, B. 2011. *Packet guide to core network protocols*. O'Reilly Media, Inc. 3. Peterson, L. L., & Davie, B. S. 2011. *Computer networks: a systems approach*. 5th Ed., Elsevier.

Advanced Data Mining					
Course Code CCS80326	**Student Workload** 90hours	**Credits** (according to ECTS) 4.5	**Semester** Semester 2	**Frequency** each even-semester	**Duration** 16 meetings

1	**Types of courses** *Elective (*Faculty level)	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** ● MPCS-ILO 1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems ● MPCS-ILO 3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** ● Students are able to choose and implement the appropriate method to analyze large databases.			
5	**Teaching methods** lectures, case study, class discussion, presentation			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			

	Information System
8	**Responsibility for module**
9	**Other information** 1. Hand, Mannila, and Smyth, 2001. Principles of Data Mining. Cambridge, MA: MIT Press. ISBN: 026208290X. 2. Berry and Linoff, 2000. Mastering Data Mining. New York, NY: Wiley. ISBN: 0471331236.

Advanced Geoinformatics					
Course Code CCS80337	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to understand the concept of geospatial data acquisition. Students are able to create a vehicle for geospatial data acquisition. Students are able to collect data from the vehicle made. Students are able to present the results of the analysis in the form of maps and the description.			

	Students are able to using the Graphical User Interface (GUI) of GIS software (GRASS GIS & QuantumGIS). Students are able to Develop programming code and scripting (GRASS GIS & QuantumGIS). Students are able to Use basic programming techniques to developing GUI to GIS software. Students are able to Know how to build an open-based WebGIS sources. Students are able to Participate in GIS solution development projects using mapping objects and object-oriented programming languages.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** Chaowei Yang. 2011. Advanced geoinformation science. USA: CRC Press, Taylor & Francis Group. International Journal in Remote Sensing & GIS. Campbell, J.B and Wynne, R.H. 2011. Introduction to Remote Sensing. USA: Guilford Press. Neteler M., and Mitasova, H. 2007. Open Source GIS: A GRASS GIS Approach. USA: Springer 5. International Journal in Remote Sensing & GIS.

Algorithm & Computation Complexity					
Course Code CCS82212	**Student Workload** 60 hours	**Credits** (according to ECTS) 3	**Semester** Sem. 2	**Frequency** each even-semester	**Duration** 16 meetings

1	**Types of courses** *compulsory (faculty level)*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems
4	**Subject aims** Students are able to understand the concept of design and analysis of algorithms in solving broad problems and be able to study various examples of algorithms and their applications. Students are able to create designs, and perform analytical calculations, to determine the correctness and accuracy of several algorithms including non-recursive algorithms, order of growth, asymptotic notation, recursive algorithms, brute force, greedy, divide & conquer, decrease & conquer, dynamic programming and backtracking algorithm, against relevant cases in various fields and multi-disciplines. Students are able to apply design concepts and algorithmic analysis in the form of program code.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information**

	1. Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Introduction To Algorithms, MIT Press/McGraw-Hill, 2001. 2. Anany Levitin, Introduction To The Design & Analysis of Algorithms, Addison Wesley, 2003.

Algorithm and Programming						
Course code CCS81001	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem.1	**frequency** each odd-semester	**duration** 16 meetings	
1	**Types of courses**	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students		
2	**Prerequisites for participation**					
3	**Learning outcomes**					
4	**Subject aims** 1. Students are able to implement the algorithmic notation into the various programming languages. 2. Students are able to make a new algorithm that does not depend on any programming languages (independent algorithm). 3. Students are able to understand the concept of object-oriented programming. 4. Students are able to make a series of commands effectively and efficient that can be understood by computer with adapting the designed system. 5. Students are able to evaluate an algorithm as terms to be well algorithm.					
5	**Teaching methods** lectures, case study, class discussion, presentation					
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment					

7	**This module is used in the following degree programmes as well**
8	**Responsibility for module**
9	**Other information** 1. C. Mary, W. Kathy and Alison H., 2000. Java Tutorial: A Short Course on the Basic. Third Edition. Adison Wesley. 2. H. M. Deitel., 2004. Java TM How to Program. Sixth Edition. Prentice Hall. 3. B. Jacquie., 2005. Begining Java Objects. From Concept to Code. Second Edition. A press.

Mobile Application Development					
Course Code CCS80251	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2	**Frequency** each even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students can get to know the development of device technology move. Students understand the concept of application development engineering mobile device.			

	Students are able to analyze, design, implement, and build device applications move either natively or web-based on the device move.
5	**Teaching methods** lectures, case study, class discussion, presentation, practice
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. ACM Multimedia Conference Proceedings 2. Tolle, Herman dkk., Buku Ajar Pengembangan Aplikasi Perangkat Bergerak. PTIIK UB. 2014. 3. Jonathan Simon. Head First Android Development. O'Reilly Media, Inc., USA. 2011. 4. Belén Cruz Zapata. Android Studio Application Development. Packt Publishing Ltd. 2013. 5. Damon Oehlman and Sébastien Blanc. Pro Android Web Apps: Develop for Android Using HTML5, CSS3 & JavaScript. Apress, 2011. 6. Hervé Guihot. Pro Android Apps Performance Optimization. Apress, 2012. 7. Nizamettin Gok and Nitin Khanna. Building Hybrid Android Apps with Java and JavaScript. O'Reilly Media, Inc., USA. 2013. 8. Cameron Banga & Josh Weinhold. Essential Mobile Interaction Design: Perfecting Interface Design in Mobile Apps. Addison Wesley, 2012. 9. Marko Gargenta and Masumi Nakamura. Learning Android, Second Edition. O'Reilly Media, Inc., USA. 2014. 10. Estelle Weyl. Mobile HTML5. O'Reilly Media, Inc., USA. 2014.

Big Data Analytics					
Course Code CCS80225	**Student Workload** 90 hours	**Credits** (according to ECTS) 4,5	**Semester** Sem. 2/3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to apply statistical methods in big-data manipulation and analysis. Students are able to apply tools in machine learning for big-data manipulation and analysis. Students are able to choose an efficient architecture for big data storage.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Michael Minelli, M., Chambers, M., Dhiraj, A., 2003. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley. 2. Barlow, M., 2013. Real-Time Big Data Analytics: Emerging Architecture, O'Reilly Media. 3. Prajapati, V., 2013. Big Data Analytics with R and Hadoop, Packt Publishing.

Computational Mathematics					
Course code CCS81002	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem.1	**frequency** each odd-semester	**duration** 16 meetings

1	**Types of courses**	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation**
3	**Learning outcomes**
4	**Subject aims** 1. Students are able to master the basic concepts of mathematical modelling. 2. Students are able to apply mathematical thinking framework to design, analyze and complete various problems related to the field of computer science/informatics. 3. Students are able to make mathematical equations computationally. 4. Students are able to use the counting and combinatorics techniques to solve the real case. 5. Students are able to design the mathematical approach to solve a problem. 6. Students are able to understand recursion and recurrence to analyze algorithms.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programmes as well**
8	**Responsibility for module**

9	**Other information** 1. Kenneth H.Rosen. 2012. Discrete Mathematics and its Applications. 7ed, The McGraw-Hill 2. Robert S. Strichartz., 2011. The Way of Analysis. rev. Edition. McGraw Hill. 3. Jos´e Augusto Ferreira. 2010. Computational Mathemmatics. Department of Mathematics University of California. 4. Howard Anton. 2010. Elementary Linier Algebra. Edition 10. John Wiley and Sons.

Computational Science					
Course code (CCS82209)	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 2	**frequency** each even-semester	**duration** 16 meetings

1	**Types of courses** *compulsory*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
5	**Prerequisites for participation** -			
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems			
3	**Subject aims** *Students are able to choose and implement efficient computational techniques for mathematical problems.*			
4	**Teaching methods** lectures, case study, class discussion, presentation			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
8	**This module is used in the following degree programmes as well**			

	Computer Science
10	**Responsibility for module**
11	**Other information** 1. Atkinson, Kendall E., 1989. *An Introduction to Numerical Analysis*. Second edition, Wiley. 2. Cheney , E. Ward and Kincaid, David R., 2004. *Numerical Mathematics and Computing*. 5th Edition, Brooks/Cole Publishers.

Computer Graphics & 3D Modeling					
Course Code CCS80255	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 & 3	**Frequency** Odd and even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to design and analyze systems graphics application and implement it in an application.			
5	**Teaching methods** lectures, case study, class discussion, presentation, practice			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			

7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Edward Angel, 2009. Interactive Computer Graphics: A Top-Down Approach Using OpenGL. Fifth Edition, Pearson International Inc,. 2. FS Hill Jr. Computer Graphics using OpenGL. 3. Donald Hearn and M. Pauline Baker. Computer Graphics with OpenGL. 3rd Edition. 4. Alan Watt. 3D Computer Graphics. Addison-Wesley. 5. Tony Parisi. 2014. Programming 3D Applications with HTML5 and WebGL. Published by O'Reilly Media, Inc., California. 6. ACM Computer in Entertainment Conference Proceedings & Journals 7. Latest publications in Graphics & 3D related conferences and journals.

Computer Networks					
Course code CCS81003	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem.1	**frequency** each odd-semester	**duration** 16 meetings

1	**Types of courses**	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes**			
4	**Subject aims** 1. Students are able to explain how computer networks work. 2. Students are able to explain the concepts and manner of working of the application layers on the internet. 3. Students are able to explain the concepts and manner of working of the application transport on the internet.			

	4. Students are able to explain the concepts and manner of working of the network layers on the internet. 5. Students are able to explain the concepts and manner of working of the link layers on the internet.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programmes as well**
8	**Responsibility for module**
9	**Other information** Kurose,Jim, & Ross, Keith. (2016). "Computer Networking: A Top-Down Approach 7th Edition". Pearson

Computer Vision					
Course Code CCS80329	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 / 3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** Elective	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation** -			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems			

	MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to carry out process control in the sector of industrial robots and automated vehicles. Students are able to detect events in the sector of visual surveillance. Students are able to model an object or environment in the sector of industrial inspection and medical image analysis. Students are able to design interaction systems between computers and humans.
5	**Teaching methods** Lectures, case study, class discussion, presentation
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Shapiro,L. & Stockman, G. 2001. *Computer Vision* PrenticeHall. 2. Jan Erik Solem, 2012. *Programming Computer Vision with Python*. O'Reilly Media. 3. Simon J.D. Prince, 2012. *Computer Vision: Models, Learning, and Inference*. Cambridge University Press. 4. Jose R.A. Torreao, 2012. *Advances in Stereo Vision*. InTech.

Advance Computer Networks					
Course Code CCS80231	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2	**Frequency** Each even-semester	**Duration** 16 meetings

1	**Types of courses** Elective	**contact hours** 63 hours	**independent study**	**class size** 40 students

			27 hours	
2	**Prerequisites for participation** -			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to understand the structure and concept of internet routing. Students are able to understand and apply routing protocols (OSPF and BGP). Students are able to identify and provide simple analysis in computer network problems.			
5	**Teaching methods** Lectures, case study, class discussion, presentation			
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			
8	**Responsibility for module**			
9	**Other information** 1. Kurose & Ross. 2012. *Computer Networking : Top down Approach.* 6th Ed., Pearson/Addison. 2. Hartpence, B. 2011. *Packet guide to core network protocols*. O'Reilly Media, Inc. 3. Peterson, L. L., & Davie, B. S. 2011. *Computer networks: a systems approach*. 5th Ed., Elsevier.			

Advanced Data Mining					
Course Code CCS80326	**Student Workload** 90hours	**Credits** (according to ECTS) 4.5	**Semester** Semester 2	**Frequency** each even-semester	**Duration** 16 meetings

1	**Types of courses** *Elective(*Faculty level *)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** Have completed analysis and systems information design course
3	**Learning outcomes** ● MPCS-ILO 1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems ● MPCS-ILO 3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** ● Students are able to choose and implement the appropriate method to analyze large databases.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well** Information System
8	**Responsibility for module**
9	**Other information** 1. Hand, Mannila, and Smyth, 2001. Principles of Data Mining. Cambridge, MA: MIT Press. ISBN: 026208290X.

	2. Berry and Linoff, 2000. Mastering Data Mining. New York, NY: Wiley. ISBN: 0471331236.

Advanced Geoinformatics					
Course Code CCS80337	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to understand the concept of geospatial data acquisition. Students are able to create a vehicle for geospatial data acquisition. Students are able to collect data from the vehicle made. Students are able to present the results of the analysis in the form of maps and the description. Students are able to using the Graphical User Interface (GUI) of GIS software (GRASS GIS & QuantumGIS). Students are able to Develop programming code and scripting (GRASS GIS & QuantumGIS). Students are able to Use basic programming techniques to developing GUI to GIS software.			

	Students are able to Know how to build an open-based WebGIS sources. Students are able to Participate in GIS solution development projects using mapping objects and object-oriented programming languages.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** Chaowei Yang. 2011. Advanced geoinformation science. USA: CRC Press, Taylor & Francis Group. International Journal in Remote Sensing & GIS. Campbell, J.B and Wynne, R.H. 2011. Introduction to Remote Sensing. USA: Guilford Press. Neteler M., and Mitasova, H. 2007. Open Source GIS: A GRASS GIS Approach. USA: Springer 5. International Journal in Remote Sensing & GIS.

Algorithm & Computation Complexity					
Course Code CCS82212	**Student Workload** 60 hours	**Credits** (according to ECTS) 3	**Semester** Sem. 2	**Frequency** each even-semester	**Duration** 16 meetings

1	**Types of courses** *compulsory (faculty level)*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students
2	**Prerequisites for participation** -			

3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems
4	**Subject aims** Students are able to understand the concept of design and analysis of algorithms in solving broad problems and be able to study various examples of algorithms and their applications. Students are able to create designs, and perform analytical calculations, to determine the correctness and accuracy of several algorithms including non-recursive algorithms, order of growth, asymptotic notation, recursive algorithms, brute force, greedy, divide & conquer, decrease & conquer, dynamic programming and backtracking algorithm, against relevant cases in various fields and multi-disciplines. Students are able to apply design concepts and algorithmic analysis in the form of program code.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Introduction To Algorithms, MIT Press/McGraw-Hill, 2001. 2. Anany Levitin, Introduction To The Design & Analysis of Algorithms, Addison Wesley, 2003.

Algorithm and Programming						
Course code CCS81001	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem.1	**frequency** each odd-semester	**duration** 16 meetings	
1	**Types of courses**	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students		
2	**Prerequisites for participation**					
3	**Learning outcomes**					
4	**Subject aims** 1. Students are able to implement the algorithmic notation into the various programming languages. 2. Students are able to make a new algorithm that does not depend on any programming languages (independent algorithm). 3. Students are able to understand the concept of object-oriented programming. 4. Students are able to make a series of commands effectively and efficient that can be understood by computer with adapting the designed system. 5. Students are able to evaluate an algorithm as terms to be well algorithm.					
5	**Teaching methods** lectures, case study, class discussion, presentation					
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment					
7	**This module is used in the following degree programmes as well**					
8	**Responsibility for module**					
9	**Other information**					

	1. C. Mary, W. Kathy and Alison H., 2000. Java Tutorial: A Short Course on the Basic. Third Edition. Adison Wesley. 2. H. M. Deitel., 2004. Java TM How to Program. Sixth Edition. Prentice Hall. 3. B. Jacquie., 2005. Begining Java Objects. From Concept to Code. Second Edition. A press.

Mobile Application Development					
Course Code CCS80251	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2	**Frequency** each even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students can get to know the development of device technology move. Students understand the concept of application development engineering mobile device. Students are able to analyze, design, implement, and build device applications move either natively or web-based on the device move.			
5	**Teaching methods** lectures, case study, class discussion, presentation, practice			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			

7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. ACM Multimedia Conference Proceedings 2. Tolle, Herman dkk., Buku Ajar Pengembangan Aplikasi Perangkat Bergerak. PTIIK UB. 2014. 3. Jonathan Simon. Head First Android Development. O'Reilly Media, Inc., USA. 2011. 4. Belén Cruz Zapata. Android Studio Application Development. Packt Publishing Ltd. 2013. 5. Damon Oehlman and Sébastien Blanc. Pro Android Web Apps: Develop for Android Using HTML5, CSS3 & JavaScript. Apress, 2011. 6. Hervé Guihot. Pro Android Apps Performance Optimization. Apress, 2012. 7. Nizamettin Gok and Nitin Khanna. Building Hybrid Android Apps with Java and JavaScript. O'Reilly Media, Inc., USA. 2013. 8. Cameron Banga & Josh Weinhold. Essential Mobile Interaction Design: Perfecting Interface Design in Mobile Apps. Addison Wesley, 2012. 9. Marko Gargenta and Masumi Nakamura. Learning Android, Second Edition. O'Reilly Media, Inc., USA. 2014. 10. Estelle Weyl. Mobile HTML5. O'Reilly Media, Inc., USA. 2014.

Big Data Analytics					
Course Code CCS80225	**Student Workload** 90 hours	**Credits** (according to ECTS) 4,5	**Semester** Sem. 2/3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation** -			
3	**Learning outcomes** MPCS-ILO1			

	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to apply statistical methods in big-data manipulation and analysis. Students are able to apply tools in machine learning for big-data manipulation and analysis. Students are able to choose an efficient architecture for big data storage.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Michael Minelli, M., Chambers, M., Dhiraj, A., 2003. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley. 2. Barlow, M., 2013. Real-Time Big Data Analytics: Emerging Architecture, O'Reilly Media. 3. 3. Prajapati, V., 2013. Big Data Analytics with R and Hadoop, Packt Publishing.

Computational Mathematics					
Course code CCS81002	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem.1	**frequency** each odd-semester	**duration** 16 meetings

1	**Types of courses**	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation**
3	**Learning outcomes**
4	**Subject aims** 1. Students are able to master the basic concepts of mathematical modelling. 2. Students are able to apply mathematical thinking framework to design, analyze and complete various problems related to the field of computer science/informatics. 3. Students are able to make mathematical equations computationally. 4. Students are able to use the counting and combinatorics techniques to solve the real case. 5. Students are able to design the mathematical approach to solve a problem. 6. Students are able to understand recursion and recurrence to analyze algorithms.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programmes as well**
8	**Responsibility for module**
9	**Other information** 1. Kenneth H.Rosen. 2012. Discrete Mathematics and its Applications. 7ed, The McGraw-Hill 2. Robert S. Strichartz., 2011. The Way of Analysis. rev. Edition. McGraw Hill.

	3. Jos´e Augusto Ferreira. 2010. Computational Mathemmatics. Department of Mathematics University of California. 4. Howard Anton. 2010. Elementary Linier Algebra. Edition 10. John Wiley and Sons.

Computational Science						
Course code (CCS82209)	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 2	**frequency** each even-semester	**duration** 16 meetings	
1	**Types of courses** *compulsory*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students		
5	**Prerequisites for participation** -					
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems					
3	**Subject aims** *Students are able to choose and implement efficient computational techniques for mathematical problems.*					
4	**Teaching methods** lectures, case study, class discussion, presentation					
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment					
8	**This module is used in the following degree programmes as well** Computer Science					
10	**Responsibility for module**					

11	**Other information** 1. Atkinson, Kendall E., 1989. *An Introduction to Numerical Analysis*. Second edition, Wiley. 2. Cheney , E. Ward and Kincaid, David R., 2004. *Numerical Mathematics and Computing*. 5th Edition, Brooks/Cole Publishers.

Computer Graphics & 3D Modeling					
Course Code CCS80255	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 & 3	**Frequency** Odd and even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to design and analyze systems graphics application and implement it in an application.			
5	**Teaching methods** lectures, case study, class discussion, presentation, practice			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			
8	**Responsibility for module**			

9	**Other information** 1. Edward Angel, 2009. Interactive Computer Graphics: A Top-Down Approach Using OpenGL. Fifth Edition, Pearson International Inc,. 2. FS Hill Jr. Computer Graphics using OpenGL. 3. Donald Hearn and M. Pauline Baker. Computer Graphics with OpenGL. 3rd Edition. 4. Alan Watt. 3D Computer Graphics. Addison-Wesley. 5. Tony Parisi. 2014. Programming 3D Applications with HTML5 and WebGL. Published by O'Reilly Media, Inc., California. 6. ACM Computer in Entertainment Conference Proceedings & Journals 7. Latest publications in Graphics & 3D related conferences and journals.

Computer Networks					
Course code CCS81003	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem.1	**frequency** each odd-semester	**duration** 16 meetings

1	**Types of courses**	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes**			
4	**Subject aims** 1. Students are able to explain how computer networks work. 2. Students are able to explain the concepts and manner of working of the application layers on the internet. 3. Students are able to explain the concepts and manner of working of the application transport on the internet. 4. Students are able to explain the concepts and manner of working of the network layers on the internet.			

	5. Students are able to explain the concepts and manner of working of the link layers on the internet.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programmes as well**
8	**Responsibility for module**
9	**Other information** Kurose,Jim, & Ross, Keith. (2016). "Computer Networking: A Top-Down Approach 7th Edition". Pearson

Computer Vision					
Course Code CCS80329	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 / 3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** Elective	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation** -			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3			

	Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to carry out process control in the sector of industrial robots and automated vehicles. Students are able to detect events in the sector of visual surveillance. Students are able to model an object or environment in the sector of industrial inspection and medical image analysis. Students are able to design interaction systems between computers and humans.
5	**Teaching methods** Lectures, case study, class discussion, presentation
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Shapiro,L. & Stockman, G. 2001. *Computer Vision* PrenticeHall. 2. Jan Erik Solem, 2012. *Programming Computer Vision with Python*. O'Reilly Media. 3. Simon J.D. Prince, 2012. *Computer Vision: Models, Learning, and Inference*. Cambridge University Press. 4. Jose R.A. Torreao, 2012. *Advances in Stereo Vision*. InTech.

Creative Media Entrepreneurship					
Course Code CCS80353	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 & 3	**Frequency** Odd and even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study**	**class size** 40 students

			27 hours	
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to recognize various media-based business opportunities creative and able to make a business plan based on business start-up creative media.			
5	**Teaching methods** lectures, case study, class discussion, presentation, practice			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			
8	**Responsibility for module**			
9	**Other information** 1. ACM Computer in Entertainment Conference Proceedings & Journals. 2. Peter F.Drucker. 1993. Innovation and Entrepreneurship. HarperBusiness. 3. W.Chan Kim, Renee Mauborgne. 2005. Blue Ocean Strategy. Harvard Business School Publishing Corporation. 4. David H.Bangs, Jr. 2001. The Business Planning Guide. Advantage Quest Publications.			

Cyber Security					
Course Code CCS80232	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2	**Frequency** Each even-semester	**Duration** 16 meetings

1	**Types of courses** Elective	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand the concept of communication security on the internet network. Students are able to understand data security techniques. Students are able to understand the techniques of securing internet online services. Students are able to identify research opportunities on certain topics presented.
5	**Teaching methods** Lectures, case study, class discussion, presentation
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information**

	1. Singh, S. 2011. *The code book: the science of secrecy from ancient Egypt to quantum cryptography*. Anchor.. 2. McClure, S., Scambray, J., Kurtz, G., & Kurtz. 2009*. Hacking exposed: network security secrets and solutions.* McGraw-Hill.. *3.* Harris, S., Ness, J., Eagle, C., Lenkey, G., & Williams, T. 2011. *Gray Hat Hacking: The Ethical Hacker's Handbook*. McGraw-Hill*.*

Database					
Course code CCS80004	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 1	**frequency** each odd-semester	**duration** 16 meetings

1	**Types of courses**	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes**			
4	**Subject aims** 1. Students are able to understand the basic concepts of databases and relational databases. 2. Students are able to identify the information requirements, a model with conceptual data model techniques, convert conceptual data model to relational data model and implement it to DBSM. 3. Students are able to build and design the database for a specified purpose so that it can be used to meet user needs.			
5	**Teaching methods** lectures, case study, class discussion, presentation			
6	**Assessment methods**			

	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programmes as well**
8	**Responsibility for module**
9	**Other information** 1. Thomas M. Connally and Carolyn E. Begg., 2009. Database system: A practical approach to design, Implementation and Management. 5th Editions. Addison Wesley. 2. Abraham Silbershatz, Henry Korth and S. Sudharshan., 2010. Data Base System Concepts. McGraw-Hill. 3. 3. Database Fundamentals. First Edition, November 2010. IBM Canada. url:https://www.ibm.com/developerworks/wikis/display/db2oncampus/FREE+ebook+-+Database+fundamentals 4. Jeffrey D. Ullman and Jennifer Widom., 2007. A First Course in Data Base System. 3rd Editions. Prentice Hall. 5. Ramez Elmasri, Shamkant B. Navathe., 2003. Fundamental of DataBase System. 4th Editions. Pearson Addition Wesley.

Digital Image Processing & Analysis					
Course Code CCS80228	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2	**Frequency** Semester 2 or 3	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** Students are able to model digital image processing in two dimensions. Students are able to make improvements in digital image processing. Students are able to associate theories and digital image processing products.			
4	**Subject aims**			

	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Pratt W.K, 2007. *Digital Image Processing*, John Wiley & Sons. 2. Jahne B, 2005. *Digital Image Processing*, Springer. 3. Prahasta E, 2008. *Remote Sensing*, Informatika Bandung. 4. Rafael C. Gonzales dan Richard E., 2002, Woods, *Digital Image Processing*, 2 Edition, Prentice Hall. 5. Rafael C. Gonzales, Richard E., 2003, Woods dan Steven L. Eddins, *Digital Image Processing using Matlab*, Prentice Hall. 6. Rafael C. Gonzales, Richard E. Woods, 2010. *Digital Image Processing*. Third Edition, Pearson Prentice Hall.

Distributed Networks						
Course Code CCS80333	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 / 3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings	
1	**Types of courses** Elective	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students		
2	**Prerequisites for participation** -					
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions					
4	**Subject aims** Students are able to understand the concept of the distributed system. Students are able to understand distributed systems computing techniques. Students are able to understand cloud computing technology. Students are able to identify research opportunities on the particular topic related.					
5	**Teaching methods** Lectures, case study, class discussion, presentation					
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment					
7	**This module is used in the following degree programs as well**					
8	**Responsibility for module**					
9	**Other information**					

	1. Buyya, R., Broberg, J., & Goscinski, A. M. (Eds.). 2010. *Cloud computing: Principles and paradigms* (Vol. 87). John Wiley & Sons. 2. Velte, T., Velte, A., & Elsenpeter, R. 2009. *Cloud computing, a practical approach.* McGraw-Hill, Inc..

Edvanced Intelligent System					
Course Code CCS80321	**Student Workload** 90 hours	**Credits** (according to ECTS) 4,5	**Semester** Sem. 2/3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation** -			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to select and implement the most appropriate advanced search for a problem. Students are able to determine the optimal parameters of the advanced search algorithm for a particular problem.			
5	**Teaching methods** lectures, case study, class discussion, presentation			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			

8	**Responsibility for module**
9	**Other information** 1. A. E. Eiben and J.E. Smith, 2003. Introduction to Evolutionary Computing. Springer. 2. Z. Michalewicz, 1996. Genetic Algorithms + Data Structures - Evolution Programs. Springer.

Embedded Software Development					
Course code CCS80343	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 2 & 3	**frequency** Each odd and even semester	**duration** 16 meeting

1	**Types of courses** *Elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
5	**Prerequisites for participation**			
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
3	**Subject aims** Students are able to understand programming principles Students are able to understand memory and its management			

	Students are able to evaluate scheduling, multitasking and multiprocessing Students are able to optimize performance Students are able to optimize power usage Students are able to understand the embedded software lifecycle
4	**Teaching methods** lectures, case studies, class discussions
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well**
10	**Responsibility for module**
11	**Other information** 1. Making Embedded Systems (O'Reilly) - Elecia White, ISBN13: 978-1-449-30214-6 2. Brian Kernighan; Dennis Ritchie (1988). The C Programming Language (2nd ed.). Prentice Hall. ISBN 978-0131103627.

Formal Method in Software Engineering					
Course code CCS80246	**student workload** 60 hours	**credits** (according to ECTS) 3	**semester** Sem. 2 & 3	**frequency** Each odd and even semester	**duration** 16 meetings
1	**Types of courses** *Elective*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students	
5	**Prerequisites for participation**				

2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
3	**Subject aims** Students are able to identify software engineering problems that require a formal approach Students are able to analyze software engineering problems and represent them in the form of a formal specification using Z notations Students are able to verify the correctness of a formal specification
4	**Teaching methods** lectures, case studies, class discussions
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well**
10	**Responsibility for module**
11	**Other information** 1. Huth, M., Ryan, M., 2004. Logic in Computer Science. 2nd Edition. Cambridge University Press. 2. Jackson, D., 2011. Software Abstractions: Logic, Language, and Analysis. MIT Press.

Game Application & Interactive Media Development					
Course Code CCS80356	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 & 3	**Frequency** Odd and even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation**
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students can get to know development and careers in games and interactive media Students are able to analyze and design games and interactive media.
5	**Teaching methods** lectures, case study, class discussion, presentation, practice
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Flint Dille & John Zuur Platten. 2007. The Ultimate Guide to Video Game Writing and Design, First Edition Lone Eagle Publishing Company. 2. Steve Rabin. 2002. AI Game Programming Wisdom, ISBN: 1-58450-077-8, Charles River Media, Inc. 3. Chad Carter. 2007. Microsoft XNA Unleashed. SAMS Publishing.

	4. Benjamin Nitschke. 2007. Professional XNA Game Programming. Wiley Publishing, Inc. 5. David Horachek. 2014. Creating E-Learning Games with Unity. Packt Publishing Ltd. March. 6. Trefay, Gregory. 2010. Casual Game Design. Morgan Kauffman. 7. Latest publications in Game AI related conferences and journals.

Information Technology & Organization					
Course Code CCS80340	**Student Workload** 90 hours	**Credits** (according to ECTS) 3	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to describe the basic concepts of information systems and enterprises. Students are able to explain the role of management and governance in the system information for enterprises. Students are able to Describe the characteristics of frameworks and processes for IT/IS governance			

	Students are able to illustrate the use of IT/IS governance in case examples through literature review or field studies
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Laudon, K. C. & Laudon, J. P., 2014. Management Information Systems. 13th ed. Pearson. 2. O'Brien, J. & Marakas, G., 2011. Management Information Systems. 10th ed. McGraw-Hill. 3. Hoogervorst, J.A.P, 2009. Enterprise Governance and Enterprise Engineering. Springer. 4. Senft, S. & Gallegos, F., 2009. Information Technology Control and Audit. 3rd ed. CRC Press. 5. Cannon, D., 2011. CISA: Certified Information Systems Auditor Study Guide, 3rd ed. Wiley.

Information Technology Entrepreneurship					
Course code **CIF62068**	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 6	**frequency** each even-Semester	**duration** 16 meetings
1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students	
5	**Prerequisites for participation** -				

2	**Learning outcomes** **MPCS-ILO4** Mastering theory and being able to apply entrepreneurial concepts in the fields of technology and computer science
3	**Subject aims** 1. Students can know and recognize aspects of the concept of techno entrepreneurship, value orientation and goal orientation. 2. Students can internalize the values and attitudes contained in entrepreneurship, such as work ethic, achievement motives, independence, creativity, decision-making skills, and so on. 3. Students are able to develop employability skills. 4. Students are able to design and disseminate creative concept ideas for business opportunities in the field of information technology.
4	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well** Computer Science (CS)
10	**Responsibility for module**
11	**Other information** 1. Buchari Alma. 2006. *Kewirausahaan*. Edisi kesepuluh. Bandung: Alfabeta 2. Geoffrey G. Meredith dkk. 1996. Kewirausahaan, Teori dan Praktek. Edisi kelima. Jakarta: PT Pustaka Binaman Pressindo. 3. Justin G. Longenecker dkk. 2001. Kewirausahaan Manajemen Usaha Kecil. Jakarta: PT. Salemba Emban Patria. 4. David C. McClelland. 1961. The Achieving Society. New York: D. Van Nostrand Company, Inc. 5. Covey, S. 2008. The 8th Habit: Menggapai Keagungan. Jakarta: PT. Gramedia Pustaka 6. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. 2008. Entrepreneurship. Singapore: McGraw-Hill International 7. Kakaya Nicholas. 2012. Technopreneurship: Conceptualised. Singapore: LAP Lambert Academic Publishing

Interaction Design					
Course Code CCS81111	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 1	**Frequency** Each odd-semester	**Duration** 16 meetings

1	**Types of courses** *Compulsory (study programme level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO-1 Graduates are expected to be able to design, build, operate, and evaluate information systems in organizations to align with organizational needs
4	**Subject aims** Students are able to understand various devices and the concept of interaction on each device. Students are able to understand the concept of interface graphic design, data visualization, and user experience. Students are able to design and implement the concept of user experience in an application for certain types of devices.
5	**Teaching methods** Lectures, case study, class discussion, presentation
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. ACM Multimedia Conference Proceedings 2. Gothelf, Jeff. *Lean UX*. O'Reilly Media, Inc., California, 2013. 3. Jodie Moule. *Killer UX Design*. SitePoint Pty. Ltd. 2012.

	4. Kirk, Andy. *Data Visualization: a successful design process*. Packt Publishing, 2012. 5. Levin, Michal. *Designing Multi-Device Experiences, An Ecosystem Approach to User Experiences Across Devices*. O'Reilly Media, Inc., California, 2014 7. Murray, Scott. *Interactive Data Visualization for the Web*. O'Reilly Media, Inc., California, 2010. 8. Neil, Theresa. *Mobile Design Pattern Gallery*. O'Reilly Media, Inc., California, 2012. 9. Sylvester, Tynan. *Designing Games*. O'Reilly Media, Inc., California, 2013. 10. Traci L. Ruthkoski. *Google Visualization API Essentials*, April 2013 11. Wendel, Stephen. *Designing for Behavior Change*. O'Reilly Media, Inc., California, 2014.

Internet Network Architecture					
Course Code CCS81110	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 1	**Frequency** Each odd-semester	**Duration** 16 meetings

1	**Types of courses** *Compulsory (study programme level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation** -			
3	**Learning outcomes** MPCS-ILO-1 Graduates are expected to be able to design, build, operate, and evaluate information systems in organizations to align with organizational needs			
4	**Subject aims** Students are able to understand the concept of Internet architecture. Students are able to identify problems in the current Internet architecture. Students are able to understand new approaches to the new Internet architecture. Students are able to identify opportunities research on presented certain topics.			
5	**Teaching methods** Lectures, case study, class discussion, presentation			
6	**Assessment methods**			

	Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Day, J. 2007. *Patterns in Network Architecture: A Return to Fundamentals.* Pearson Education. 2. Tronco, T. (Ed.). 2010. *New Network Architectures: The path to the future internet* (Vol. 297). Springer Science & Business Media. 3. Pan, J., Paul, S., & Jain, R. 2011. *A Survey of The Research on Future Internet Architectures*. Communications Magazine, IEEE, 49(7), 26-36.

Introduction to Embedded System					
Course Code CCS80242	**Student Workload** 90 hours	**Credits** (according to ECTS) 3	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims**			

	Students are able to understand the basic concepts of embedded systems Students are able to understand and be able to design architecture embedded systems according to system requirements. Students are able to understand the basic concepts of programming firmware in embedded systems
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** Alippi, C., 2014. Intelligence for Embedded Systems, Springer. Kaur, S., 2013. Transitioning Embedded Systems To Intelligent Environments: A Journey Through Evolving Technologies, CreateSpace Independent Publishing Platform

Introduction to Geoinformatics					
Course Code CCS80236	**Student Workload** 90 hours	**Credits** (according to ECTS) 3	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO1			

	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand the concept of geoinformatics Students are able to perform geospatial data classification. Students are able to analyze geospatial data. Students are able to present the results of the analysis in the form of maps and the description.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Chaowei Yang. 2011. Advanced geoinformation science. USA: CRC Press, Taylor & Francis Group. 2. International Journal in Remote Sensing & GIS. 3. Campbell, J.B and Wynne, R.H. 2011. Introduction to Remote Sensing. USA: Guilford Press

Machine Learning					
Course Code CCS80220	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2/3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to select and implement the most suitable artificial neural network for a problem. Students are able to modify or optimize the existing artificial neural network to improve the quality of the results.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Rajasekaran, S., Vijaylakshmi, G.A., Pai, 2003. Neural Networks, Fuzzy Logic, and Genetic Algorithms. Prentice-Hall of India Pvt. Ltd.

	2. Hertz, John, Anders Krogh, and Richard G. Palmer 1991. Introduction to the Theory of Neural Computation. Redwood City, CA: Addison-Wesley Pub. Co., 1991.

Mobile Application Development						
Course Code CCS80251		**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem.2	**Frequency** each even-semester	**Duration** 16 meetings
1	**Types of courses** *elective*		**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students	
2	**Prerequisites for participation** Completed Multimedia System					
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions					
4	**Subject aims** Students are able to perform abstraction and data representation (CPL: KK4)					
5	**Teaching methods** lectures, case study, class discussion, presentation, practice					
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment					
7	**This module is used in the following degree programs as well**					
8	**Responsibility for module**					

9	**Other information** 1. Edward Angel. Interactive Computer Graphics, 4th edition. Addison Wesley, 2006 2. Eric Lengyel. Mathematics for 3D Game Programming and Computer Graphics", Cengage Learning, 2012 3. Joey de Vries. Learn OpenGL, An offline transcript of learnopengl.com, 2015

Proposal Preparation					
Course Code CCS82271	**Student Workload** 60 hours	**Credits** (according to ECTS) 3	**Semester** Sem. 2	**Frequency** Even-semester	**Duration** 16 meetings

1	**Types of courses** *compulsory*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-2 Mastering theory and able to apply research methodologies to produce innovative and tested research products in the fields of technology and computer science			
4	**Subject aims** Students are able to formulate a thesis proposal systematically and clearly.			
5	**Teaching methods** lectures, case study, class discussion, presentation, practice			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			

8	**Responsibility for module**
9	**Other information** -

Proposal Seminar					
Course Code CCS81372	**Student Workload** 60 hours	**Credits** (according to ECTS) 3	**Semester** Sem. 3	**Frequency** Odd-semester	**Duration** 16 meetings

1	**Types of courses** *compulsory*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-2 Mastering theory and able to apply research methodologies to produce innovative and tested research products in the fields of technology and computer science			
4	**Subject aims** Students are able to present proposals verbally well and explain various questions related to the research material that will be carried out clearly and measurably.			
5	**Teaching methods** lectures, case study, class discussion, presentation, practice			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			
8	**Responsibility for module**			

9	**Other information** -

Real-time System					
Course code CCS80344	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 2 & 3	**frequency** Each odd and even semester	**duration** 16 meetings

1	**Types of courses** *Elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
5	**Prerequisites for participation**			
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
3	**Subject aims** Students are able to explain the basic concepts and terminology of real-time systems Students are able to build a task scheduler using different scheduling policies on multiple systems Students are able to analyzing timing behavior of the system and scheduling policy Students are able to discuss the advantages and disadvantages of various scheduling policies			

	Students are able to discuss the influence of hardware and software on the timing behavior of the system Students are able to identify the parameters of a scheduling scheme or set of tasks based on the output of the system Students are able to formulate a system specification of an implementation Students are able to evaluate scheduling overheads Students are able to implement event-based scheduling policies
4	**Teaching methods** lectures, case studies, class discussions
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well**
10	**Responsibility for module**
11	**Other information** Hard Real-Time Computing Systems by G.C. Buttazzo, Springer 2005

Research Induction					
Course Code CCS81170	**Student Workload** 60 hours	**Credits** (according to ECTS) 3	**Semester** Sem. 1	**Frequency** Odd-semester	**Duration** 16 meetings

1	**Types of courses** *compulsory*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1			

	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-2 Mastering theory and able to apply research methodologies to produce innovative and tested research products in the fields of technology and computer science MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to conduct literature studies for current topics related to the study of each Research Group. Students are able to present the results of literature studies conducted on certain topics. Students are able to identify research opportunities that match their interests.
5	**Teaching methods** lectures, case study, class discussion, presentation, practice
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** Papers that become a reference for discussion can be taken from various sources of quality international publications, both proceedings and journals.

Research Methodology & Scientific Paper Writing					
Course code UBU80001	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 1	**frequency** each odd-semester	**duration** 16 meetings

1	**Types of courses** *Compulsory*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation**
3	**Learning outcomes** Mastering theory and being able to apply research methodologies to produce innovative and tested research products in the fields of technology and computer science (MPCS-ILO2)
4	**Subject aims** 1. Students are able to understand the advanced concepts of scientific research. 2. Students are able to do a review of different types of research. 3. Students are able to draft scientific research proposals.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programmes as well** Master Program Computer Science
8	**Responsibility for module**
9	**Other information** 1. Creswell, John W. dan Clark, Vicki L. Plano. 2011. Designing and Conducting Mixed Methods Research. USA: Sage Publicatios, Inc. 2. Creswell, John W. 2013. Qualitative Inquiry and Research Design Choosing Among Five Approaches. USA: Sage Publications

	3. Patton, M.Q. 2001. Qualitative Research and Evaluation Methods.Thousands Oak, CA: Sage Publications.

Scientific Publications					
Course Code CCS82473	**Student Workload** 60 hours	**Credits** (according to ECTS) 3	**Semester** Sem. 4	**Frequency** Even-semester	**Duration** 16 meetings

1	**Types of courses** *compulsory*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-2 Mastering theory and able to apply research methodologies to produce innovative and tested research products in the fields of technology and computer science MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to explain in writing part or all of the thesis research material in the form of a quality journal paper under the direction of the Thesis Supervisor. Students are able to get acceptance letters from accredited national journals or reputable international journals for journal papers that have been made.			
5	**Teaching methods** lectures, case study, class discussion, presentation, practice			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
7	**This module is used in the following degree programs as well**			

8	**Responsibility for module**
9	**Other information** -

Smart System						
Course code (CCS81108)	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 1	**frequency** each odd-semester	**duration** 16 meetings	
1	**Types of courses** *compulsory*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students		
5	**Prerequisites for participation** -					
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems					
3	**Subject aims** 1. *Students are able to* apply types of fuzzy inference. 2. Able to understand the concept of classification and fuzzy pattern recognition. 3. Able to explain the main factors to achieve good performance learning and generalization in Artificial Neural Networks (ANN). 4. Able to identify, evaluate and implement ANN in various cases. 5. Able to select and implement evolutionary computing techniques for optimization problems. 6. Able to hybridize several techniques in evolutionary computing, artificial neural networks, and fuzzy logic for solving complex problems effectively and efficiently.					
4	**Teaching methods**					

	lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well** Computer Science (CS)
10	**Responsibility for module**
11	**Other information** 1. Fogel, D.B., 2005. *Evolutionary Computation: Toward a New Philosophy of Machine Intelligence*. 3rd Edition. New Jersey: John Wiley & Sons. 2. Russell, S., Norvig, P., 2003. Artificial Intelligence: A Modern Approach. 3rd Edition. New Jersey: Prentice Hall. 3. Eberhart, R.C., Shi, Y. 2007. Computational Intelligence: Concepts to Implementations. Morgan Kaufmann.

Software Engineering Modeling					
Course code CCS80348	**student workload** 60 hours	**credits** (according to ECTS) 3	**semester** Sem. 2 & 3	**frequency** Each odd and even semester	**duration** 16 meetings

1	**Types of courses** *Elective*	**contact hours** 42 hours	**independent study** 18 hours	**class size** 40 students
5	**Prerequisites for participation**			
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3			

	Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
3	**Subject aims** Students are able to understand the concepts and modeling techniques required in the software development process Students are able to apply modeling techniques, both structured and object-oriented, in a software engineering problem
4	**Teaching methods** lectures, case studies, class discussions
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well**
10	**Responsibility for module**
11	**Other information** 1. Pressman, R.S., 2009. Software Engineering – A Practitioner's Approach. 7th Edition. McGraw-Hill Science. 2. Sommerville, I., 2010. Software Engineering. 9th Edition. AddisonWesley. 3. Vliet, H., 2008. Software Engineering: Principles and Practice. 3rd Edition. Wiley. 4. Bennet, S., McRobb, S., Farmer, R, 2010. Object-Oriented Systems Analysis and Design. McGraw-Hill. 5. Larman, C., 2005. Applying UML and Patterns. Pearson Education Inc.

Software Engineering Project Management					
Course code CCS80347	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 2 & 3	**frequency** Each odd and even semester	**duration** 16 meetings

1	**Types of courses** *Elective*	**contact hours** 63 hours	**independent study**	**class size** 40 students

			27 hours	
5	**Prerequisites for participation**			
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
3	**Subject aims** Students are able to understand the influence of the SDLC model on software project management Students are able to understand the basic concepts of software project management Students are able to apply project management techniques in software project planning			
4	**Teaching methods** lectures, case studies, class discussions			
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment			
8	**This module is used in the following degree programmes as well**			
10	**Responsibility for module**			
11	**Other information** 1. Pressman, R.S., 2009. Software Engineering – A Practitioner's Approach. 7th Edition. McGraw-Hill Science. 2. Sommerville, I., 2010. Software Engineering. 9th Edition. AddisonWesley. 3. Vliet, H., 2008. Software Engineering: Principles and Practice. 3rd Edition. Wiley. 4. Hughes, B., Cotterell, M., 2009. Software Project Management. 5th Edition. McGraw-Hill.			

Software Engineering Quality						
Course code CCS80245	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 2	**frequency** each even-semester	**duration** 16 meetings	
1	**Types of courses** *Elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students		
5	**Prerequisites for participation**					
2	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions					
3	**Subject aims** Students are able to understand the basic techniques of software testing and analysis Students are able to conduct literature studies of English-language papers for current topics testing and analysis of emerging complex software systems (e.g. real time, embedded, game, mobile) Students are able to presenting the results of literature studies conducted on certain topics Students are able to identify research opportunities on specific topics presented					
4	**Teaching methods** lectures, case studies, class discussions					
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment					

8	**This module is used in the following degree programmes as well**
10	**Responsibility for module**
11	**Other information** 1. Pressman, R.S., 2009. Software Engineering – A Practitioner's Approach. 7th Edition. McGraw-Hill Science. 2. Sommerville, I., 2010. Software Engineering. 9th Edition. Addison-Wesley. 3. Vliet, H., 2008. Software Engineering: Principles and Practice. 3rd Edition. Wiley. 4. Journal of the ACM Transactions on Software Engineering and Methodology (TOSEM). ACM. 5. Journal of the IEEE Transactions on Software Engineering (TSE). IEEE. 6. Proceedings of the IEEE International Conference on Software Testing, Verification and Validation (ICST). IEEE. 7. Proceedings of the International Conference on Software Engineering (ICSE). Springer.

Software Engineering					
Course code (CCS81107)	**student workload** 90 hours	**credits** (according to ECTS) 4.5	**semester** Sem. 1	**frequency** each odd-semester	**duration** 16 meetings

1	**Types of courses** *compulsory*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
5	**Prerequisites for participation** -			
2	**Learning outcomes** **MPCS-ILO1** Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems			

	MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
3	**Subject aims** 1. *Students are able to* explain well the role and urgency of Software Engineering approach in software development. 2. Able to describe the concepts in analyzing, designing, implementing and testing software. 3. Able to apply modeling techniques in Software Engineering, both structured and object-oriented approaches. 4. Able to describe the latest topics in the Software Engineering concept.
4	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well** Computer Science (CS)
10	**Responsibility for module**
11	**Other information** 1. Pressman, R.S., 2009. *Software Engineering – A Practitioner's Approach*. 7th Edition. McGraw-Hill Science. 2. Sommerville, I., 2010. Software Engineering. 9th Edition. Addison Wesley. 3. Vliet, H., 2008. Software Engineering: Principles and Practice. 3rd Edition. Wiley. 4. Bennet, S., McRobb, S., Farmer, R., 2010. Object-Oriented Systems Analysis and Design. 4th Edition. McGraw-Hill. 5. Larman, C., 2004. Applying UML and Patterns. 3rd Edition. Prentice Hall.

Special Topics in Computational Intelligence					
Course Code CCS80222	**Student Workload** 90 hours	**Credits** (according to ECTS) 4,5	**Semester** Sem. 2/3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand and be able to implement the latest techniques related to computational computing.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** Russell, S., Norvig, P., 2003. Artificial Intelligence: A Modern Approach. 3rd Edition. New Jersey: Prentice Hall

Special Topics in Decision Support System					
Course Code CCS80323	**Student Workload** 90 hours	**Credits** (according to ECTS) 4,5	**Semester** Sem. 2/3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation** -
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand the basics of DSS design and development. Students are able to adopt current and future DSS implementation challenges.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information**

	1. Marakas, George M., Decision Support Systems in the 21st Century. 2nd Edition, Prentice Hall, 2003 2. Sprague, Ralph, H & Hugh, J. Watson, Decision Support Systems. Prentice Hall, Inc., 1993 3. Turban, Efraim & Aronson, Jay E., Decision Support Systems and Intelligent Systems. 8th edition, Prentice Hall, Upper Saddle River, NJ, 2007

Special Topics in Game & Educational Media					
Course Code CCS80356	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 & 3	**Frequency** Odd and even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to understand the basic concepts and implementation of game optimization and multiplayer online games. Students are able to study literature in English for the latest topics in game applications. Students are able to present the results of literature studies conducted on certain topics.			

	Students are able to identify research opportunities on certain topics presented.
5	**Teaching methods** lectures, case study, class discussion, presentation, practice
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Journal of Gaming & Virtual Worlds (JGVW). Intellect Book. 2. International Journal of Game Theory. Springer. 3. Michael Hugos. 2012. Enterprise Games. Published by O'Reilly Media, Inc., California. 4. Aung Sithu Kyaw et al., 2013. Unity 4.x Game AI Programming. Packt Publishing, Birmingham. 5. ACM Computer in Entertainment Conference Proceedings & Journals . 6. Latest publications in Game AI related conferences and journals.

Special Topics in Geoinformatics					
Course Code CCS80338	**Student Workload** 90 hours	**Credits** (according to ECTS) 3	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO1			

	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand the application / application of geoinformatics. Students are able to Apply geospatial technology and computer science to address physical and social problems.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** International Journal in Remote Sensing & GIS, and Its Applications.

Special Topics in Mobile Application					
Course Code CCS80354	**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 & 3	**Frequency** Odd and even-semester	**Duration** 16 meetings

1	**Types of courses** *elective*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			

3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand basic concepts and implementation aspects optimization and security of mobile applications. Students are able to do literature study papers in English for the latest topics of game applications. Students are able to make presentations on the results of literature studies carried out on a specific topic. Students are able to identify research opportunities on certain topics presented.
5	**Teaching methods** lectures, case study, class discussion, presentation, practice
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 6. Hervé Guihot. 2012. Pro Android Apps Performance Optimization. Springer Apress, New York. 7. Satya Komatineni and Dave MacLean. 2013. Expert Android. Springer Apress, New York. 8. International Journal of Interactive Mobile Technologies (IJIM). 9. Latest publications in Mobile Application related conferences and journals.

Special Topics in Network Traffic Engineering						
Course Code CCS80334		**Student Workload** 90 hours	**Credits** (according to ECTS) 4.5	**Semester** Sem. 2 / 3	**Frequency** Even-semester or odd-semester	**Duration** 16 meetings
1	**Types of courses** Elective		**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students	
2	**Prerequisites for participation** -					
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions					
4	**Subject aims** Students are able to understand network traffic engineering. Students are able to understand how to monitor network traffic. Students are able to identify and analyze problems in network traffic.					
5	**Teaching methods** Lectures, case study, class discussion, presentation					
6	**Assessment methods** Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment					
7	**This module is used in the following degree programs as well**					
8	**Responsibility for module**					
9	**Other information**					

	1. Ash, G. R. 2006. *Traffic Engineering and QoS Optimization of Integrated Voice & Data Networks*. Morgan Kaufmann. 2. Kurose & Ross. 2012. "*Computer Networking : Top-Down Approach*", 6th Ed., Pearson/Addison. 3. Peterson, L. L., & Davie, B. S. 2011. *Computer Networks: A Systems Approach*. 5th Ed., Elsevier.

Special Topics in Programmable Networks					
Course Code CCS80335	**Student Workload** 90 hours	**Credits** (according to ECTS) 3	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to identify and understand current issues in programmed network formation. Students are able to conduct literature studies for current topics that related to programmatic networks.. Students are able to make a presentation of the results of the literature study conducted on a specific topic.			
5	**Teaching methods**			

	lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Sezer, S., Scott-Hayward, S., Chouhan, P. K., Fraser, B., Lake, D., Finnegan, J., & Rao, N. 2013. Are We Ready for SDN? Implementation Challenges for Software-Defined Networks. Communications Magazine, IEEE, 51(7), 36-43. 2. G.A.A. Santana, "Data Center Virtualization Fundamentals," Cisco Press, 2013, ISBN:1587143240. 3. K. Hwang, J. Dongarra, G.C. Fox, "Distributed and Cloud Computing," Morgan Kaufmann 2011, ISBN:0123858801. 4. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective," CRC Press, 2012, ISBN:1439892997

Special Topics in Software Engineering					
Course code CCS80350	**student workload** 120 hours	**credits** (according to ECTS) 6	**semester** Sem. 2	**frequency** each even-semester	**duration** 16 meetings

1	**Types of courses** *Elective*	**contact hours** 84 hours	**independent study** 36 hours	**class size** 40 students
5	**Prerequisites for participation**			
2	**Learning outcomes** MPCS-ILO1			

	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
3	**Subject aims** Students are able to understand the concept of software design Students are able to conduct a literature study of English-language papers for the latest topics of software design Students are able to present the results of literature studies conducted on certain topics. Students are able to identify research opportunities on the particular topic presented
4	**Teaching methods** lectures, case studies, class discussions
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
8	**This module is used in the following degree programmes as well**
10	**Responsibility for module**
11	**Other information** 1. Pressman, R.S., 2009. Software Engineering – A Practitioner's Approach. 7th Edition. McGraw-Hill Science. 2. Sommerville, I., 2010. Software Engineering. 9th Edition. AddisonWesley. 3. Vliet, H., 2008. Software Engineering: Principles and Practice. 3rd Edition. Wiley. 4. Journal of the ACM Transactions on Software Engineering and Methodology (TOSEM). ACM.

Special Topics in User Experience & Information System					
Course Code CCS80341	**Student Workload** 90 hours	**Credits** (according to ECTS) 3	**Semester** Smt 2/3	**Frequency** each odd-semester/ each even semester	**Duration** 16 meetings

1	**Types of courses** *Elective (study program level)*	**contact hours** 63 hours	**independent study** 27 hours	**class size** 40 students

2	**Prerequisites for participation**
3	**Learning outcomes** MPCS-ILO1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions
4	**Subject aims** Students are able to understand and explain current problems/approaches related to users experience and information systems.
5	**Teaching methods** lectures, case study, class discussion, presentation
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** 1. Laudon, K. C. & Laudon, J. P., 2014. Management Information Systems. 13th ed. Pearson.

	2. O'Brien, J. & Marakas, G., 2011. Management Information Systems. 10th ed. McGraw-Hill. 3. Hoogervorst, J.A.P, 2009. Enterprise Governance and Enterprise Engineering. Springer. 4. Senft, S. & Gallegos, F., 2009. Information Technology Control and Audit. 3rd ed. CRC Press. 5. Cannon, D., 2011. CISA: Certified Information Systems Auditor Study Guide, 3rd ed. Wiley.

Thesis Exam					
Course Code CCS82473	**Student Workload** 150 hours	**Credits** (according to ECTS) 3	**Semester** Sem. 4	**Frequency** Even-semester	**Duration** 16 meetings

1	**Types of courses** *compulsory*	**contact hours** 105 hours	**independent study** 45 hours	**class size** 40 students
2	**Prerequisites for participation**			
3	**Learning outcomes** MPCS-ILO-1 Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems MPCS-ILO-2 Mastering theory and able to apply research methodologies to produce innovative and tested research products in the fields of technology and computer science MPCS-ILO-3 Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions			
4	**Subject aims** Students are able to explain in writing the results that have been obtained while conducting thesis research systematically and scientifically in the form of a thesis document.			

	Students are able to explain verbally well and systematically the results of thesis research that have been obtained and various questions posed by the Thesis Examiner Council.
5	**Teaching methods** lectures, case study, class discussion, presentation, practice
6	**Assessment methods** assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment
7	**This module is used in the following degree programs as well**
8	**Responsibility for module**
9	**Other information** -