Adva	nce Com	outer Networks					
Cour	se Code	Student	Credits	Semeste	r	Frequency	Duration
CCS8	0231	Workload	(accordin	Sem. 2		Each even-	16 meetings
		90 hours	g to ECTS)			semester	
			4.5				
1	Types of	courses	conta	ct hours	i	independent	class size
	Elective		63	hours		study	40 students
						27 hours	
2	Prerequ	isites for partici	pation				
	-						
3	Learning	goutcomes					
	MPCS-IL	01					
	Masterir technolo	ng theory and	able to co er science th	onduct stuc	lies ropr	on the applicat iate for certain p	ion of the latest roblems
	MPCS-IL	03			- 1-	· · · · · · ·	
	Masterir	ng theory and be	eing able to	apply engir	neer	ing concepts to p	produce innovative
	and test	ed computer-ba	sed solution	ns		0	
4	Subject aims						
	Students	s are able to und	erstand the	e structure a	and	concept of intern	et routing.
	Students	s are able to und	erstand and	d apply rout	ting	protocols (OSPF a	and BGP).
	Students problem	s are able to i s.	dentify and	d provide s	simp	ole analysis in c	omputer network
5	Teaching	g methods					
	Lectures	, case study, clas	ss discussio	n, presenta	tion		
6	Assessm	ent methods					
	Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment						roject evaluation,
7	This mo	dule is used in tl	ne followin	g degree pr	ogra	ams as well	
8	Respons	ibility for modu	le				
9	Other in	formation					

- 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.

Adva	nced Dat	a Mining							
Cour	se Code	Student	Credits	Semeste	r	Frequency		Duration	
CCS8	0326	Workload	(accordin	Semester	2	each even-		16 meetings	
		90hours	g to			semester		0	
			ECTS)						
			4.5						
1	Types of	courses	conta	ct hours		independent	c	lass size	
	Elective	(Faculty level)	63	hours		study	40	) students	
						27 hours			
2	Prerequ	isites for partici	pation						
3	Learning	z outcomes							
-									
								- <b>C</b> i h e de la cent	
	t	echnology and c	omputer sc	ience that a	are a	appropriate for co	ertain	problems	
	• •	APCS-ILO 3							
	N	Mastering theor nnovative and te	y and being ested compu	g able to a uter-based	pply solu	y engineering co Itions	ncepts	to produce	
4	Subject	aims							
	• 5	tudents are able	to choose	and implem	nent	t the appropriate	metho	bd	
	t	o analyze large o	latabases.						
5	Teachin	g methods							
	lectures	, case study, clas	s discussior	n, presentat	ion				
6	Assessm	ent methods							
	assignm	ent. mid-term	examinatio	on, end-te	rm	examination, p	roiect	evaluation.	
	practica	-skill assessmen	t	,		- · · · · · · · · · · · · / P			
7	This mo	dule is used in tl	ne following	g degree pr	ogr	ams as well			

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

Adva	nced Geo	oinformatics					
Cours	se Code	Student	Credits	Semeste	er	Frequency	Duration
CCS8	0337	Workload	(accordin	Smt 2/3	}	each odd-	16 meetings
		90 hours	ECTS)			semester/	
			4.5			each even semester	
1	Types of	fcourses	conta	ct hours		independent	class size
	Elective	(study progra	m 63	hours		study	40 students
	level)					27 hours	
2	Prerequ	isites for partici	pation				
3	Learning	goutcomes					
	MPCS-IL	01					
	Masterir technolo	ng theory and ogy and compute	able to co er science tl	onduct stud hat are app	dies ropr	on the applicat riate for certain p	tion of the latest roblems
	MPCS-IL	03					
	Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions						
4	Subject	aims					
	Students	s are able to und	lerstand the	e concept of	fge	ospatial data acqu	uisition.
	Students are able to create a vehicle for geospatial data acquisition.						
	Students	s are able to coll	ect data fro	om the vehic	cle r	nade.	
	Students are able to present the results of the analysis in the form of maps and the description.					n of maps and the	

	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, prozet 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.

Algo	rithm & C	omputation Cor	nplexity					
Cour	se Code	Student	Credits	Semester		Frequency	Duration	
CCS8	2212	Workload	(accordin	Sem. 2		each even-	16 meeting	zs
		60 hours	g to ECTS)			semester		
			3					
1	Types o	f courses	conta	ct hours		independent	class size	
-	compuls	orv (faculty leve	1) 42	hours		study	40 students	
	computs			nours		18 hours		
2	Prerequ	isites for partici	pation					
	-							
3	Learnin	goutcomes						
	MPCS-IL	.0-1						
	Masteri	ng theory and	able to co	onduct stud	ies	on the applica	ion of the late	est
	technol	ogy and compute	er science th	nat are appr	opr	iate for certain p	roblems	
4	Subject	aims						
	Student	s are able to un	derstand th	ne concept	of d	lesign and analys	is of algorithms i	in
	solving l applicat	oroad problems ions.	and be able	e to study va	irio	us examples of al	gorithms and the	eir
	Student	s are able to cre	ate designs	, and perfor	m a	analytical calculat	ions, to determin	ne
	the corr order of	ectness and accu growth, asympt	iracy of sev otic notatic	eral algorith on. recursive	ims alg	including non-re orithms. brute fo	cursive algorithm rce. greedv. divic	ıs, de
	& conqu	uer, decrease &	conquer, d	ynamic pro	grar	mming and backt	racking algorithm	n,
	against	relevant cases in	various fiel	ds and mult	:i-di	sciplines.		
	Student program	s are able to ap 1 code.	ply design	concepts a	nd	algorithmic analy	sis in the form o	of
5	Teachin	g methods						
	lectures	, case study, clas	s discussior	n, presentat	ion			
6	Assessm	nent methods						
	assignm practica	ent, mid-term I-skill assessmen	examinatio t	on, end-tei	m	examination, p	roject evaluatio	'n,
7	This mo	dule is used in tl	he followin	g degree pr	ogra	ams as well		
8	Respons	sibility for modu	le					
9	Other in	formation						

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.

Algor	rithm and	Programming						
Cours	se code	student	credits	semeste	r	frequency		duration
CCS8	1001	workload	(accordin	Sem.1		each odd-		16 meetings
		90 hours	ECTS)			semester		
			4.5					
1	Types of	courses	conta	ontact hours		independent		class size
	1		62	hours		study		10 students
			05	nours		27 hours		40 Students
2	Droroqui	isites for partici	nation					
2	Fielequ		pation					
3	Learning	g outcomes						
4	Subject	aims						
	1. Stud	ents are able	to implem	ent the a	lgor	ithmic notation	into	o the various
	prog	ramming langua	ges.					
	2. Stude prog	ents are able t ramming langua	to make a ges (indepe	new algoi ndent algoi	rithı Tithr	m that does no m).	t de	epend on any
	3. Stud	ents are able to	understand	the concep	t of	object-oriented	prog	gramming.
	4. Stude be ur	ents are able to nderstood by co	make a ser mputer with	ies of comr n adapting t	nan :he (	ds effectively and designed system.	d eff	icient that can
	5. Stud	ents are able to	evaluate an	algorithm	as te	erms to be well a	lgori	thm.
5	Teaching	g methods						
	lectures,	, case study, clas	s discussior	n, presentat	ion			
6	Assessm	ent methods						
	assignmo practical	ent, mid-term ex I-skill assessmen	kamination, t	end-term e	exan	nination, project	eval	uation,

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.

Mob	ile Applica	ation Developm	ent				
Cour	se Code	Student	Credits	Semeste	r Freque	ncy	Duration
CCS8	0251	Workload	(accordin	Sem. 2	each ev	en-	16 meetings
		90 hours	ECTS)		semest	ter	
			4.5				
1	Types of	courses	conta	ct hours	indonondon	•	
-	i ypes of	courses	Conta	,	study	•	
	elective		63	hours	27 hours		40 students
					27 110013		
2	Prerequ	isites for partici	pation				
3	Learning	; outcomes					
	MPCS-IL	0-1					
	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems						
	MPCS-IL	0-3					
	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
	lactures case study class discussion presentation practice
	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.
	<ol> <li>Jonathan Simon. Head First Android Development. O'Reilly Media, Inc., USA. 2011.</li> </ol>
	<ol> <li>Belén Cruz Zapata. Android Studio Application Development. Packt Publishing Ltd. 2013.</li> </ol>
	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 D	Big Data Analytics							
Cour CCS8	<b>se Code</b> 0225	Student Workload 90 hours	Credits (accordin g to ECTS) 4,5	Semeste Sem. 2/3	er 3	Frequency Even-semester odd-semester	or -	<b>Duration</b> 16 meetings
1	Types of elective	courses	conta 63	<b>ct hours</b> hours		independent study 27 hours		<b>class size</b> 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
	<ol> <li>Michael Minelli, M., Chambers, M., Dhiraj, A., 2003. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley.</li> </ol>
	<ol> <li>Barlow, M., 2013. Real-Time Big Data Analytics: Emerging Architecture, O'Reilly Media.</li> </ol>
	3. Prajapati, V., 2013. Big Data Analytics with R and Hadoop, Packt Publishing.

Computational Mathematics							
Cour	se code	student	credits	semeste	r frequency	duration	
CCS8	1002	workload	(accordin g to	Sem.1	each odd-	16 meetings	
		90 hours	ECTS)		semester		
			4.5				
1	Types of	f courses	conta	ct hours	independent	class size	
			63	hours	study	40 students	
					27 hours		
2	Prerequ	isites for partici	pation				
3	Learning	goutcomes					
4	Subiect	aims					
	1 Stud	ents are able to	master the	hasic conce	nts of mathematical	modelling	
	2 Stud	ents are able to	annly math	ematical thi	pts of mathematical	design analyze and	
	com	plete various pro	blems relat	ed to the fi	eld of computer scie	nce/informatics.	
	3. Stud	ents are able to	make math	ematical eq	uations computatior	nally.	
	4. Stud real	ents are able to case.	use the co	unting and	combinatorics techr	niques to solve the	
	5. Stud	ents are able to	design the r	mathematic	al approach to solve	a problem.	
	6. Stud	ents are able to	understand	recursion a	nd recurrence to an	alyze algorithms.	
5	Teachin	g methods					
	lectures	, case study, clas	s discussior	n, presentat	ion		
6	Assessm	nent methods					
	assignm	ent, mid-term ex	kamination,	end-term e	xamination, project	evaluation,	
	practica	l-skill assessmen	t				
7	This mo	dule is used in tl	he following	g degree pr	ogrammes as well		
8	Respons	sibility for modu	le				

9	Otl	her 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	<b>credits</b> (accordin g to ECTS)	semeste Sem. 2	r frequency each even- semester	duration 16 meetings	
			4.5				
1	Types of	courses	conta	ct hours	independent	class size	
	compuls	ory	63	hours	study	40 students	
					27 hours		
5	Prerequ	isites for partici	pation				
	-						
2	Learning	goutcomes					
	MPCS-IL	01					
	Masterir technolo	ng theory and ab ogy and compute	ole to condu er science th	ict studies c nat are appi	n the application o opriate for certain	<sup>:</sup> the latest problems	
3	Subject aims						
	Students are able to choose and implement efficient computational techniques for mathematical problems.						
4	Teachin	g methods					
	lectures, case study, class discussion, presentation						
6	Assessment methods						
	assignment, mid-term examination, end-term examination, project evaluation, 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								
Cour	se Code	Student	Credits	Semester		Frequency		Duration
CCS8	0255	Workload	(accordin	Sem. 2 & 3		Odd and even	-	16 meetings
		90 hours	g to ECTS)			semester		Ū
			4.5		-			
1	Types of	courses	conta	ct hours		independent		class size
	elective		63	hours		study	4	0 students
						27 hours		
2	Prerequ	isites for partici	pation		1			
3	Learning	outcomes						
	MPCS-IL	0-1						
	Masterir technolo	ng theory and ogy and compute	able to co er science th	nduct stud nat are app	dies ropr	on the applica riate for certain p	tion roble	of the latest ms
	MPCS-IL	0-3						
	Masterir and test	ng theory and be ed computer-ba	eing able to sed solutior	apply engii 1s	neei	ring concepts to p	orodu	ce innovative
4	Subject	aims						
	Students	s are able to des	ign and ana	lyze system	ns gr	aphics application	n and	implement it
	in an app	olication.						
5	Teaching	g methods						
	lectures, case study, class discussion, presentation, practice							
6	Assessm	ent methods						
	assignm practical	ent, mid-term -skill assessmen	examinatio t	on, end-te	rm	examination, p	rojec	t evaluation,

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 student		student	credits	semeste	r frequency	duration
CCS8	1003	workload	(accordin	Sem.1	each odd-	16 meetings
		90 hours	ECTS)		semester	
			4.5			
1	Types of	courses	conta	ct hours	independent	class size
			63	hours	study	40 students
					27 hours	
2	Prerequ	isites for partici	pation			
3	Learning	outcomes				
4	Subject	aims				
-			avalain hav		n o truce al construction	
	I. Stud	ents are able to	explain nov	<i>computer</i>	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.					
<ol><li>Students are able to explain the concepts and manner of working of the link layers on the internet.</li></ol>					
Teaching methods					
lectures, case study, class discussion, presentation					
Assessment methods					
assignment, mid-term examination, end-term examination, project evaluation,					
practical-skill assessment					
This module is used in the following degree programmes as well					
Responsibility for module					
Other information					
Kurose,Jim, & Ross, Keith. (2016). "Computer Networking: A Top-Down Approach 7th Edition". Pearson					

Computer Vision								
Course Code		Student	Credits	Semeste	r Freq	uency	Duration	
CCS8	0329	Workload	(accordin	Sem. 2 /	3 Even-sei	mester or	16 meetings	
		90 hours	ECTS)		odd-se	emester		
			4.5					
1	Types of	courses	conta	ct hours	independ	ent	class size	
	Elective		63	63 hours			40 students	
					27 hour	ſS		
2	Prerequ	isites for partici	pation					
	-							
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, prozet 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.						
	<ol> <li>Jan Erik Solem, 2012. Programming Computer Vision with Python. O'Reilly Media.</li> <li>Simon J.D. Prince, 2012. Computer Vision: Models, Learning, and Inference. Cambridge University Press.</li> <li>Jose R.A. Torreao, 2012. Advances in Stereo Vision. InTech.</li> </ol>						

Advance Computer Networks							
Course Code CCS80231		Student Workload 90 hours	Credits (accordin g to ECTS) 4.5	Semeste Sem. 2	r Frequency Each even- semester	<b>Duration</b> 16 meetings	
1     Types of courses       Elective		conta 63	<b>ct hours</b> hours	independent study	class size 40 students		

			27 hours			
2	Prerequisites for participa	tion				
	-					
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 bein and tested computer-base	g able to apply engiı d solutions	neering concepts to p	produce innovative		
4	Subject aims					
	Students are able to under	stand the structure a	and concept of interr	net routing.		
	Students are able to under	stand and apply rout	ing protocols (OSPF	and BGP).		
	Students are able to ide problems.	ntify and provide	simple analysis in o	computer network		
5	Teaching methods					
	Lectures, case study, class	discussion, presenta	tion			
6	Assessment methods					
	Assignment, mid-term ei practical-skill assessment	xamination, end-te	rm examination, p	roject evaluation,		
7	This module is used in the	following degree pr	ograms as well			
8	Responsibility for module					
9	Other information					
	<ol> <li>Kurose &amp; Ross. 2012. Pearson/Addison.</li> </ol>	Computer Networ	king : Top down A	<i>pproach.</i> 6th Ed.,		
	2. Hartpence, B. 2011. <i>Pacl</i> 3. Peterson, L. L., & Davie, I Elsevier.	ket guide to core net B. S. 2011. Computer	work protocols. O'Re networks: a systems	illy Media, Inc. <i>approach</i> . 5th Ed.,		

Advanced Data Mining								
Cour CCS8	<b>se Code</b> 0326	Student Workload 90hours	<b>Credits</b> (accordin g to ECTS)	Semeste Semester	<b>r</b> 2	Frequency each even- semester	1	<b>Duration</b> .6 meetings
			4.5					
1	Types of	f courses	conta	ct hours		independent	cl	lass size
	Elective	(Faculty level )	63	hours		study	40	students
-	-	••• •				27 nours		
2	Prerequ	isites for partici	pation					
	Have co	mpleted analysis	s and syster	ns informat	ion	design course		
3	Learning	g outcomes						
	• 1	MPCS-ILO 1						
	r t	Mastering theory echnology and c	y and able t computer so	to conduct : cience that a	stuo are a	dies on the appli appropriate for c	cation o ertain p	of the latest problems
	• 1	MPCS-ILO 3						
	۲ i	Mastering theor nnovative and te	y and being ested comp	g able to a uter-based s	ppl solu	y engineering co ıtions	ncepts	to produce
4	Subject	aims						
	• 5	Students are able	e to choose	and implem	nen	t the appropriate	metho	d
	t	o analyze large o	databases.					
5	Teachin	g methods						
	lectures	, case study, clas	s discussion	n, presentat	ion			
6	Assessm	nent methods						
	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment							
7	This mo	dule is used in t	he followin	g degree pr	ogr	ams as well		
	Information System							
8	Responsibility for module							
9	Other in	formation						
	1. Hand, Press.	. Mannila, and S . ISBN: 02620829	5myth, 2001 90X.	1. Principles	s of	Data Mining. Ca	mbridg	ge, MA: MIT

Adva	nced Geo	informatics						
Course Code CCS80337		Student Workload 90 hours	Credits (accordin g to ECTS) 4.5	Semester Smt 2/3		Frequency each odd- semester/ each even semester		<b>Duration</b> 16 meetings
1 2	1Types of coursescontact hoursindeElective (study program63 hours2level)22Prerequisites for participation			independent study 27 hours		<b>class size</b> 40 students		
2	Loorning	, outcomos						
	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 Students	aims s are able to und	erstand the	e concept of	fgeo	ospatial data acqu	uisiti	ion.
	Students Students	s are able to creater able to creater able to coll	ate a vehicle ect data fro	e for geospa om the vehic	atial cle n	data acquisition. nade.		
	Students descript	s are able to pre ion.	esent the ro	esults of the	e an	alysis in the forn	n of	maps and the
	Students are able to using the Graphical User Interface (GUI) of GIS software (GRASS GIS & QuantumGIS).							
	Students Quantur	s are able to nGIS).	Develop p	rogrammin	g co	ode and scriptir	ng (	GRASS GIS &
	Students software	s are able to Us e.	se basic pr	ogramming	tec	chniques to deve	lopi	ng GUI to GIS

	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, prozet 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		Student	Credits	Semeste	r Frequency	Duration		
CCS82212		Workload 60 hours	(accordin g to ECTS)	Sem. 2	each even- semester	16 meetings		
			3					
1	Types of courses		conta	ct hours	independent	class size		
	compulsory (faculty level)		<i>l)</i> 42	hours	study	40 students		
					18 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
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, project evaluation, practical-skill assessment
7	This module is used in the following degree programs as well
8	Responsibility for module
9	Other information
	<ol> <li>Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Introduction To Algorithms, MIT Press/McGraw-Hill, 2001.</li> <li>Anany Levitin, Introduction To The Design &amp; Analysis of Algorithms, Addison Wesley, 2003.</li> </ol>

Algorithm and Programming									
Cour: CCS8	<b>se code</b> 1001	<b>student</b> workload 90 hours	credits (accordin g to ECTS) 4.5	semeste Sem.1	r frequency each odd- semester	duration 16 meetings			
1	Types of courses		conta 63 pation	contact hours indep 63 hours 27		class size 40 students			
3	Learning outcomes								
4	<ol> <li>Subject aims</li> <li>Students are able to implement the algorithmic notation into the various programming languages.</li> <li>Students are able to make a new algorithm that does not depend on any programming languages (independent algorithm).</li> <li>Students are able to understand the concept of object-oriented programming.</li> <li>Students are able to make a series of commands effectively and efficient that can be understood by computer with adapting the designed system.</li> </ol>								
5	<b>Teachin</b> lectures	<b>g methods</b> , case study, clas	s discussior	n, presentat	ion				
6	Assessment methods assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment								
7	This mo	dule is used in t	he following	g degree pr	ogrammes as well				
8	Responsibility for module								
9	Other in	formation							

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								
Cour	se Code	Student	Credits	Semeste	er	Frequency	Du	ration
CCS8	0251	Workload	(accordin	Sem. 2		each even-	16 m	neetings
		90 hours	g to ECTS)			semester		
			45					
1	Types of	Courses	conta	ct hours		independent	class	sizo
-	alactiva	courses	62	bours		study	40 ctu	donte
	elective		05	nours		27 hours	40 Stu	uents
2	Preregu	isites for partici	pation					
	•							
3	Learning	outcomes						
•	MPCS-II	0-1						
	Masterir	ng theory and	able to co	nduct stuc	انەم	on the applicat	ion of th	ne latest
	technolo	ogy and compute	er science th	nat are appi	ropri	iate for certain p	oblems	
	MPCS-IL	0-3						
	Masterin and test	ng theory and be ed computer-ba	eing able to sed solution	apply engin	neer	ing concepts to p	roduce in	novative
4	Subject	aims						
	Students	s can get to know	v the devel	opment of a	devid	ce technology mo	ove.	
	Students understand the concept of application development engineering mobile device.							
	Students either na	s are able to and atively or web-ba	alyze, desig ased on the	n, impleme device mov	ent, a ve.	and build device	applicatio	ns move
5	Teachin	g methods						
	lectures	, case study, clas	s discussior	n, presentat	tion,	practice		
6	Assessm	ent 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						
	<ol> <li>Tolle, Herman dkk., Buku Ajar Pengembangan Aplikasi Perangkat Bergerak. PTIIK UB. 2014.</li> </ol>						
	<ol> <li>Jonathan Simon. Head First Android Development. O'Reilly Media, Inc., USA. 2011.</li> </ol>						
	<ol> <li>Belén Cruz Zapata. Android Studio Application Development. Packt Publishing Ltd. 2013.</li> </ol>						
	<ol> <li>Damon Oehlman and Sébastien Blanc. Pro Android Web Apps: Develop for Android Using HTML5, CSS3 &amp; JavaScript. Apress, 2011.</li> </ol>						
	6. Hervé Guihot. Pro Android Apps Performance Optimization. Apress, 2012.						
	<ol> <li>Nizamettin Gok and Nitin Khanna. Building Hybrid Android Apps with Java and JavaScript. O'Reilly Media, Inc., USA. 2013.</li> </ol>						
	8. Cameron Banga & Josh Weinhold. Essential Mobile Interaction Design: Perfecting Interface Design in Mobile Apps. Addison Wesley, 2012.						
	<ol> <li>Marko Gargenta and Masumi Nakamura. Learning Android, Second Edition. O'Reilly Media, Inc., USA. 2014.</li> </ol>						
	10. Estelle Weyl. Mobile HTML5. O'Reilly Media, Inc., USA. 2014.						

Big D	Big Data Analytics							
Cour	se Code	Student	Credits	Semeste	r Frequency	Duration		
CCS8	0225	Workload	(accordin	Sem. 2/3	B Even-semeste	r or 16 meetings		
		90 hours	ECTS)		odd-semest	er		
			4,5					
1	Types of	courses	contact hours		independent	class size		
	elective		63 hours		study	40 students		
					27 hours			
2	Prerequisites for participation							
	-							
3	Learning	outcomes						
	MPCS-IL	01						

	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, prozet 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						
	<ol> <li>Barlow, M., 2013. Real-Time Big Data Analytics: Emerging Architecture, O'Reilly Media.</li> </ol>						
	3. 3. Prajapati, V., 2013. Big Data Analytics with R and Hadoop, Packt Publishing.						

Com	Computational Mathematics								
Cours CCS8	<b>se code</b> 1002	student workload 90 hours	<b>credits</b> (accordin g to ECTS)	semester Sem.1	each odd- semester	duration 16 meetings			
1	1 Types of courses			<b>ct hours</b> hours	independent study 27 hours	class size 40 students			
2	Prerequ	isites for partici	pation						
3	Learnin	g outcomes							
4	<ol> <li>Subject aims</li> <li>Students are able to master the basic concepts of mathematical modelling.</li> <li>Students are able to apply mathematical thinking framework to design, analyze and complete various problems related to the field of computer science/informatics.</li> <li>Students are able to make mathematical equations computationally.</li> <li>Students are able to use the counting and combinatorics techniques to solve the real case.</li> <li>Students are able to design the mathematical approach to solve a problem.</li> </ol>								
5	Teachin	<b>g methods</b> , case study, clas	ss discussior	n, presentat	on				
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	Respons	sibility for modu	le						
9	<ul> <li>Other information</li> <li>1. Kenneth H.Rosen. 2012. Discrete Mathematics and its Applications. 7ed, The McGraw-Hill</li> <li>2. Robert S. Strichartz., 2011. The Way of Analysis. rev. Edition. McGraw Hill.</li> </ul>								

	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.

Course code (CCS82209)student workload 90 hourscredits (accordin g to ECTS)semesterfrequency each even- semesterduration 16 meeting1Types of courses compulsorycontact hours 63 hoursindependent studyclass size 40 students5Prerequisites for participation	Computational Science							
Image: Notice     Image: Notice       1     Types of courses     contact hours     independent       compulsory     63 hours     study       27 hours     27 hours	gs							
1     Types of courses     contact floars     findependent     class size       compulsory     63 hours     study     40 students       5     Prerequisites for participation								
Compulsory     63 hours     40 students       27 hours     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								
3 Subject aims								
Students are able to choose and implement efficient computational techniques for								
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. <i>An Introduction to Numerical Analysis</i> . Second edition, Wiley.							
	2. Cheney, E. Ward and Kincaid, David R., 2004. <i>Numerical Mathematics and Computing</i> , 5th Edition, Brooks/Cole Publishers							

Computer Graphics & 3D Modeling								
Cour	se Code	Student	Credits	Semeste	er	Frequency		Duration
CCS8	0255	Workload	(accordin	Sem. 2 &	3	Odd and even	-	16 meetings
		90 hours	g to ECTS)			semester		
			4.5					
1	Types of	courses	conta	ct hours		independent	C	class size
	elective		63	hours		study	40	) students
						27 hours		
2	Prerequ	isites for partici	pation					
3	Learning	g outcomes						
	MPCS-IL	0-1						
	Masterir	ng theory and	able to co	onduct stud	dies	on the applicat	tion c	of the latest
	technolo	ogy and compute	er science th	nat are app	ropr	iate for certain p	roblen	ns
	MPCS-IL	0-3						
	Masterir and test	ng theory and be ed computer-ba	eing able to sed solutior	apply engines	neer	ing concepts to p	oroduo	ce innovative
4	Subject	aims						
	Students in an ap	s are able to des plication.	ign and ana	lyze system	ns gr	aphics applicatio	n and	implement it
5	Teaching	g methods						
	lectures,	, case study, clas	s discussior	n, presentat	tion,	practice		
6	Assessm	ent methods						
	assignment, mid-term examination, end-term examination, project evaluation, protect evaluation,							evaluation,
7	This mo	dule is used in t	he following	g degree pr	ogra	ams as well		
8	Respons	ibility for modu	le					

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.						

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Computer Networks							
Course code		student	credits	semeste	r frequenc	y duration	
CCS8	1003	workload	(accordin	Sem.1	each odd	- 16 meetings	
		90 hours	g to		semeste	r	
			ECTSJ				
			4.5				
1	Types of	courses	conta	ct hours	independent	class size	
			63	hours	study	40 students	
					27 hours		
2	Brorogu	isitos for partisi	nation				
2	Prerequ	isites for partici	pation				
3	Learning	g outcomes					
		•					
4	Subject	aims					
	1. Stuc	lents are able to	explain ho	w compute	r networks work.		
	2. Stuc	lents are able to	explain the	concepts a	nd manner of work	ing of the application	
	laye	rs on the interno lents are able to	et. explain the	concents a	nd manner of work	ing of the application	
	tran	sport on the int	ernet.	concepts a			
	4. Stuc	lents are able to	o explain the	e concepts	and manner of wo	rking 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, 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 Student		Credits	Semester		Frequency		Duration	
CCS80329		Workload	(accordin	Sem. 2 / 3		Even-semester o odd-semester		16 meetings
		90 hours	g to ECTS)					
			4.5					
1	Types of	f courses	conta	contact hours		independent		class size
	Elective		63	63 hours		study		40 students
						27 hours		
2	Prerequ	isites for partici	pation					
	-							
3	Learning	g 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							of the latest ems
	MPCS-IL	03						

	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.
	<ol> <li>Jan Erik Solem, 2012. Programming Computer Vision with Python. O'Reilly Media.</li> <li>Simon J.D. Prince, 2012. Computer Vision: Models, Learning, and Inference. Cambridge University Press.</li> <li>Jose R.A. Torreao, 2012. Advances in Stereo Vision. InTech.</li> </ol>

Creative Media Entrepreneurship								
Course Code CCS80353		Student Workload 90 hours	Credits (accordin g to ECTS) 4.5	Semester Sem. 2 & 3		Frequency Odd and even semester	<b>Duration</b> 16 meetings	
1     Types of courses       elective		conta 63	contact hours 63 hours		independent study	class size 40 students		

			27 hours				
2	Prerequisites for participat	tion					
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 recoge and able to make a busines are as a second seco	gnize various media ss plan based on bus	-based business opp iness start-up creativ	ortunities creative re media.			
5	Teaching methods						
	lectures, case study, class c	liscussion, presentat	ion, practice				
6	Assessment methods						
	assignment, mid-term ex practical-skill assessment	xamination, end-te	rm examination, p	roject evaluation,			
7	This module is used in the	following degree pr	ograms as well				
8	Responsibility for module						
9	Other information						
	<ol> <li>ACM Computer in Enter</li> <li>Peter F.Drucker. 1993.</li> <li>W.Chan Kim, Renee Ma School Publishing Corp</li> </ol>	ertainment Conferen Innovation and Entr auborgne. 2005. Blu oration.	ce Proceedings & Jou epreneurship. Harpe e Ocean Strategy. Ha	urnals. rBusiness. rvard Business			
	4. David H.Bangs, Jr. 2001 Publications.	L. The Business Plani	ning Guide. Advantag	ge Quest			

Cybe	Cyber Security								
Cour	se Code	Student	Credits	Semeste	r Frequency	/ Duration			
CCS8	0232	Workload	(accordin	Sem. 2	Each even	- 16 meetings			
		90 hours	ECTS)		semester				
			4.5						
1	Types of	f courses	conta	ct hours	independent	class size			
	Elective		63	hours	study	40 students			
					27 hours				
2	Prerequ	isites for partici	pation						
	-								
3	Learning	goutcomes							
	MPCS-IL	.01							
	Masterii technolo	ng theory and ogy and compute	able to co er science th	onduct stud nat are appl	lies on the applic opriate for certain	ation of the latest problems			
	MPCS-IL	.03							
	Masterin and test	ng theory and be ed computer-ba	eing able to sed solutior	apply engir 1s	neering concepts to	produce innovative			
4	Subject	aims							
	Students network	s are able to und 	erstand the	concept of	communication sec	curity on the internet			
	Students	s are able to und	lerstand dat	ta security t	echniques.				
	Students	s are able to und	lerstand the	e technique	s of securing intern	et online services.			
	Student	s are able to ide	ntify researd	ch opportur	nities on certain top	pics presented.			
5	Teachin	g methods							
	Lectures	s, case study, cla	ss discussio	n, presenta	tion				
6	Assessm	nent methods							
	Assignm practica	ent, mid-term I-skill assessmen	examinatio t	on, end-te	rm examination,	project evaluation,			
7	This mo	dule is used in t	he following	g degree pr	ograms as well				
8	Respons	sibility for modu	le						
9	Other in	formation							

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

Database								
Course code CCS80004		student workload 90 hours	credits (accordin g to ECTS) 4.5	semeste Sem. 1	r	<b>frequency</b> each odd- semester	duration 16 meetings	
1	1 Types of courses			act hours i		ndependent 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.							
	<ol> <li>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.</li> </ol>							
	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								
	<ol> <li>Thomas M. Connally and Carolyn E. Begg., 2009. Database system: A practical approach to design, Implementation and Management. 5th Editions. Addison Wesley.</li> </ol>								
	<ol> <li>Abraham Silbershatz, Henry Korth and S. Sudharshan., 2010. Data Base System Concepts. McGraw-Hill.</li> </ol>								
	<ol> <li>3. Database Fundamentals. First Edition, November 2010. IBM Canada. url:https://www.ibm.com/developerworks/wikis/display/db2oncampus/FREE+eb ook+-+Database+fundamentals</li> </ol>								
	<ol> <li>Jeffrey D. Ullman and Jennifer Widom., 2007. A First Course in Data Base System.</li> <li>3rd Editions. Prentice Hall.</li> </ol>								
	<ol> <li>Ramez Elmasri, Shamkant B. Navathe., 2003. Fundamental of DataBase System. 4th Editions. Pearson Addition Wesley.</li> </ol>								

Digital Image Processing & Analysis									
Course CodeSCCS80228Wg		Student Workload 90 hours	Credits (accordin g to ECTS)	Semester Sem. 2		<b>Frequency</b> Semester 2 or 3		<b>Duration</b> 16 meetings	
			4.5						
1	Types of	fcourses	conta	ct hours		independent		class size	
	elective		63	hours		study	40 students		
					27 hours				
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, <i>Digital Image</i>									
	Processing using Matlab, Prentice Hall.									
	6. Rafael C. Gonzales, Richard E. Woods, 2010. <i>Digital Image Processing</i> . Third Edition,									
	6. Raidel C. Golizales, Richard E. Woods, 2010. Digital image Processing. Third Edition,									
	Pearson Prentice Hall.									

Distributed Networks								
Course Code		Student	Credits	Semeste	er	· Frequency		Duration
CCS8	0333	Workload	(accordin	Sem. 2 /	3	Even-semester	or	16 meetings
		90 hours	g to ECTS)			odd-semester		
			4.5					
1	Types of	fcourses	conta	ct hours	i	independent	C	class size
	Elective		63	hours		study	40	) students
						27 hours		
2	Prerequ	isites for partici	pation					
	-							
3	Learning	goutcomes						
	MPCS-IL	01						
	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	g methods						
	Lectures, case study, class discussion, presentation							
6	Assessment methods							
	Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment							
7	This mo	dule is used in t	he following	g degree pr	ogra	ams as well		
8	Respons	ibility for modu	le					
9	Other in	formation						
1. Buyya, R., Broberg, J., & Goscinski, A. M. (Eds.). 2010. <i>Cloud computing: Principles and paradigms</i> (Vol. 87). John Wiley & Sons.								
--								
2. Velte, T., Velte, A., & Elsenpeter, R. 2009. <i>Cloud computing, a practical approach.</i> McGraw-Hill, Inc								

Edva	Edvanced Intelligent System							
Cour	se Code	Student	Credits	Semeste	er	Frequency		Duration
CCS8	0321	Workload	(accordin g to	Sem. 2/3	3	Even-semester	or	16 meetings
		90 hours	ECTS)			odd-semester	r	
			4,5					
1	Types of	courses	conta	ct hours	i	independent		class size
	elective		63	hours		study		40 students
						27 hours		
2	Prerequ	isites for partici	pation					
	-							
3	Learning	outcomes						
	MPCS-IL	01						
	Masterir technolo	ng theory and ogy and compute	able to co er science th	onduct stud nat are appr	dies ropri	on the application on the application of the second	tion roble	of the latest ems
	MPCS-IL	03						
	Masterir and test	ng theory and be ed computer-ba	eing able to sed solutior	apply engii 1s	neer	ing concepts to p	orod	uce innovative
4	Subject	aims						
	Students problem	are able to sele	ct and impl	ement the	mos	t appropriate adv	/anc	ed search for a
	Students algorithr	s are able to d n for a particula	letermine t r problem.	he optima	l pa	rameters of the	adv	vanced search
5	Teaching	g methods						
	lectures,	. case study, clas	s discussior	n, presentat	tion			
6	Assessm	ent methods						
	assignm practical	ent, mid-term -skill assessmen	examinatio t	on, end-te	rm	examination, p	roje	ct evaluation,
7	This mo	dule is used in tl	he following	g degree pr	ogra	ams 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								
Cour	se code	student	credits	semester		frequency		duration
CCS8	0343	workload	(accordin	Sem. 2 &	3	Each odd and ev	ven	16 meeting
		90 hours	g to ECTS)			semester		
			4 5					
			4.5					
1	Types of	courses	conta	ct hours		independent		class size
	Elective		63	hours		study		40 students
						27 hours		
5	Prerequ	isites for partici	pation					
		-						
2	Learning	goutcomes						
	MPCS-IL	01						
	Masterir	ng theory and at	ole to condu	ict studies c	on th	ne application of t	the l	atest
	technolo	ogy and compute	er science tł	nat are appi	ropr	iate for certain p	robl	ems
	MPCS-IL	03						
	Masterir	ng theory and be	eing able to	apply engir	neer	ing concepts to p	rodu	uce innovative
	and test	ed computer-ba	sed solution	ns				
3	Subject aims							
	Students	are able to unc	lerstand pro	ogramming	prin	ciples		
	Students	s are able to unc	lerstand me	emory and i	ts m	anagement		

	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						
	<ol> <li>Making Embedded Systems (O'Reilly) - Elecia White, ISBN13: 978-1-449-30214-6</li> <li>Brian Kernighan; Dennis Ritchie (1988). The C Programming Language (2nd ed.). Prentice Hall. ISBN 978-0131103627.</li> </ol>						

Formal Method in Software Engineering								
Course code CCS80246		student workload 60 hours	credits (accordin g to ECTS) 3	semeste Sem. 2 &	3 Eac	<b>frequency</b> h odd and even semester	duration 16 meetings	
1	1 Types of courses <i>Elective</i>		conta 42	contact hours 42 hours		pendent tudy hours	<b>class size</b> 40 students	
5	Prerequ	isites for partici	pation					

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.

Gam	Game Application & Interactive Media Development							
Cours	se Code	Student	Credits	Semester		Frequency		Duration
CCS8	0356	Workload	(accordin	Sem. 2 &	3	Odd and even	-	16 meetings
		90 hours	g to ECTS)			semester		
			45					
1	Types of	COURSES	conta	ct hours		independent		class size
-	alactiva	courses	62	hours	I	study		10 students
	elective		03	nours		27 hours	-	to students
2	Prerequ	isites for partici	pation					
	-							
3	Learning	g outcomes						
	MPCS-IL	0-1						
	Masterir	ng theory and	able to co	onduct stud	ies	on the applicat	tion	of the latest
	technolo	bgy and compute	er science tł	nat are appr	opr	iate for certain p	roble	ems
	MPCS-IL	0-3						
	Masterir	ng theory and be	eing able to	apply engir	neer	ing concepts to p	produ	uce innovative
	and test	ed computer-ba	sed solutior	าร				
4	Subject	aims						
	Students	s can get to know	v developm	ent and car	eers	s in games and in	terad	ctive media
	Students	s are able to ana	lyze and de	sign games	and	interactive medi	ia.	
5	Teachin	g methods						
	lectures	, case study, clas	s discussior	n, presentat	ion,	practice		
6	Assessm	ent methods						
	assignm practical	ent, mid-term I-skill assessmen	examinatio t	on, end-ter	m	examination, p	rojec	t evaluation,
7	This mo	dule is used in tl	he following	g degree pro	ogra	ams as well		
8	Respons	ibility for modu	le					
9	Other in	formation						
	1. Flint	Dille & John Zu	ur Platten. 2	2007. The U	ltim	ate Guide to Vide	eo Ga	ame Writing
	and	Design, First Edi	tion Lone E	agle Publish	ing	Company.		77 9 Charles
	Z. Stev Rive	e Rabin. 2002. A r Media, Inc.	a Game Pro	Riginining A	VISC	JUIII, ISBN: 1-584	50-0	//-o, Charles
	3. Cha	d Carter. 2007. N	/licrosoft XN	NA Unleashe	ed. S	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								
Cours	se Code	Student	Credits	Semeste	r	Frequency		Duration
CCS8	0340	Workload	(accordin	Smt 2/3		each odd-		16 meetings
		90 hours	g to ECTS)			semester/		
			3			each even		
						semester		
1	Types of	fcourses	conta	ct hours		independent		class size
	Elective	(study progra	<i>m</i> 63	hours		study	4	40 students
	level)					27 hours		
2	2 Prerequisites for participation							
3	Learning	goutcomes						
	MPCS-IL	01						
	Masterir technolo	ng theory and ogy and compute	able to co er science th	nduct stuc nat are appr	lies ropr	on the applicat iate for certain p	tion roble	of the latest ems
	MPCS-IL	03						
	Masterir and test	ng theory and be ed computer-ba	eing able to sed solutior	apply engir 1s	neei	ring concepts to p	orod	uce innovative
4	Subject	aims						
	Students enterpri	s are able to ses.	describe tl	ne basic c	onc	epts of informa	tion	systems and
	Students are able to explain the role of management and governance in the system information for enterprises.							
	Students governa	s are able to Des nce	cribe the ch	aracteristic	s of	frameworks and	prod	cesses for IT/IS

	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, prozet 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, L. & Marakas, G., 2011, Management Information Systems, 10th ed.							
	McGraw-Hill.							
	3. Hoogervorst, J.A.P, 2009. Enterprise Governance and Enterprise Engineering.							
	Springer.							
	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	<b>credits</b> (accordin g to ECTS)	semester Sem. 6	each even- Semester	duration 16 meetings		
			4.5					
1	<b>Types of</b> elective	courses	conta 63	<b>ct hours</b> hours	independent study 27 hours	class size 40 students		
5	Prerequi -	isites for partici	pation					

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
	<ol> <li>Students can know and recognize aspects of the concept of techno entrepreneurship, value orientation and goal orientation.</li> <li>Students can internalize the values and attitudes contained in entrepreneurship, such as work ethic, achievement motives, independence, creativity, decision- making skills, and so on.</li> <li>Students are able to develop employability skills.</li> <li>Students are able to design and disseminate creative concept ideas for business opportunities in the field of information technology.</li> </ol>
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
	<ol> <li>Buchari Alma. 2006. <i>Kewirausahaan</i>. Edisi kesepuluh. Bandung: Alfabeta</li> <li>Geoffrey G. Meredith dkk. 1996. Kewirausahaan. Teori dan. Praktek. Edisi kelima.</li> </ol>
	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
	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

Inter	action De	sign					
Cours	se Code	Student	Credits	Semester	Fre	equency	Duration
CCS8	1111	Workload	(accordin	Sem. 1	Ea	ach odd-	16 meetings
		90 hours	g to ECTS)		se	emester	
			4.5				
1	Types of	courses	conta	ct hours	indepe	ndent	class size
	Compuls	ory (study	63	hours	stud	dy	40 students
	program	ime level)			27 hc	ours	
2	Prerequ	isites for partici	pation				
	-						
3	Learning	goutcomes					
	MPCS-IL	0-1					
	Graduat	es are expected	to be able t	o design, bu	ild, operat	te, and eva	luate information
	systems	in organizations	to align wit	h organizat	onal needs	S	
4	Subject	aims					
	Students device.	s are able to und	erstand var	ious devices	and the co	oncept of ir	iteraction on each
	Students visualiza	s are able to u tion, and user ex	understand kperience.	the conce	ot of inte	rface grap	ohic design, data
	Students applicati	s are able to de ion for certain ty	esign and i pes of devi	mplement t ces.	he concep	ot of user	experience in an
5	Teachin	g methods					
	Lectures	, case study, clas	ss discussio	n, presentat	ion		
6	Assessm	ent methods					
	Assignm practical	ent, mid-term I-skill assessmen	examinatio t	on, end-ter	m examir	nation, pr	oject evaluation,
7	This mo	dule is used in tl	ne following	g degree pro	ograms as	well	
8	Respons	ibility for modu	le				
9	Other in	formation					
	1. ACM	1 Multimedia Co	nference Pr	oceedings			
	2. Gotl	nelf, Jeff. <i>Lean U</i>	X. O'Reilly N	Media, Inc.,	California,	2013.	
	3. Jodie Moule. <i>Killer UX Design</i> . 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.

Inter	Internet Network Architecture						
Course Code CCS81110		Student Workload	Credits (accordin	Semeste Sem. 1	r	<b>Frequency</b> Each odd-	Duration 16 meetings
		90 hours	ECTS) 4.5			semester	
1	Types of	courses	conta	ct hours	indep	oendent	class size
	Compuls	ory (study	63	hours	st	udy	40 students
	program	ime level)			27	hours	
2	Prerequisites for participation						
	-						
3	Learning outcomes						
	MPCS-IL	0-1					
	Graduat systems	es are expected in organizations	to be able t to align wit	to design, b th organizat	uild, ope ional nee	rate, and eva	aluate information
4	Subject	aims					
	Students	s are able to und	lerstand the	e concept of	Internet	architecture	2.
	Students	are able to ide	ntify proble	ms in the cu	irrent Int	ernet archite	ecture.
	Students	s are able to und	lerstand nev	w approach	es to the	new Interne	et architecture.
	Students are able to identify opportunities research on presented certain topics.						
5	Teaching methods						
	Lectures	, case study, cla	ss discussio	n, presenta	ion		
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
0	
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.

Intro	Introduction to Embedded System						
Course Code Student C		Credits	Semester		Frequency	Duration	
CCS80242 Workle		Workload	(accordin	Smt 2/3		each odd-	16 meetings
		90 hours	g to			semester/	
			ECIS)			each even	
			3			semester	
1	Types of	courses	conta	ct hours	i	independent	class size
	Elective	(study progra	m 63	hours		study	40 students
	level)					27 hours	
2	Prerequ	isites for partici	pation		1		
3	Learning	outcomes					
	MPCS-IL	01					
	Masterir	ng theory and	able to co	onduct stud	dies	on the applicat	tion of the latest
	technolo	ogy and compute	er science th	nat are app	ropri	iate for certain p	roblems
	MPCS-IL	03					
	Mastering theory and being able to apply engineering concepts to produce innovative						
	and test	and tested computer-based solutions					
4	Subject	aims					

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

Introduction to Geoinformatics						
Course Code		Student	Credits	Semeste	r Frequency	Duration
CCS80236		Workload 90 hours	(accordin g to ECTS) 3	Smt 2/3	each odd- semester/ each even semester	16 meetings
1	1 Types of courses Elective (study program level)		m 63	<b>ct hours</b> hours	independent study 27 hours	class size 40 students
2	Prerequ	isites for partici	pation			
3	Learning	<b>g outcomes</b> ∩1				
		01				

	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	practical-skill assessment This module is used in the following degree programs as well						
7	practical-skill assessment This module is used in the following degree programs as well						
7 8	practical-skill assessment This module is used in the following degree programs as well Responsibility for module						
7 8 9	practical-skill assessment This module is used in the following degree programs as well Responsibility for module Other information						

Mach	Machine Learning							
Cour	se Code	Student	Credits	Semeste	r Frec	quency	Duration	
CCS8	0220	Workload	(accordin	Sem. 2/3	Even-se	mester or	16 meetings	
		90 hours	g to ECTS)		odd-s	emester		
			4.5					
1	Types of	f courses	conta	ct hours	independ	lent	class size	
-	elective		63	hours	study	,	40 students	
	ciccive		05	nours	27 hou	rs		
2	Prereguisites for participation							
	_							
3	Learning outcomes							
	MPCS-IL	.01						
	Masterii	ng theory and	able to co	nduct stud	ies on the	application	of the latest	
	technolo	ogy and compute	er science th	nat are app	opriate for c	ertain prob	lems	
	MPCS-IL	.03						
	Masterii and test	ng theory and be ed computer-ba	ing able to sed solutior	apply engin	eering conce	epts to proc	luce innovative	
4	Subject	aims						
	Students for a pro	s are able to sele bblem.	ect and imp	lement the	most suitab	le artificial	neural network	
	Students are able to modify or optimize the existing artificial neural network to improve the quality of the results.							
5	Teachin	g methods						
	lectures	. case studv. clas	s discussior	n. presentat	ion			
6	Assessm	nent methods		<i>,</i> ,				
	assignm	ent. mid-term	examinatio	on. end-te	m examina	tion. proie	ect evaluation.	
	practica	l-skill assessmen	t	,			,	
7	This mo	dule is used in th	ne following	g degree pr	ograms as w	ell		
8	Respons	sibility for modu	le					
9	Other in	formation						
	1. Raja Gen	isekaran, S., Vija etic Algorithms.	ylakshmi, G Prentice-Ha	G.A., Pai, 20 all of India F	03. Neural N vt. Ltd.	letworks, F	uzzy Logic, and	

## 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.

Mobi	Mobile Application Development						
Course Code		Student	Credits	Semeste	r	Frequency	Duration
CCS80251		Workload	(accordin	Sem.2		each even-	16 meetings
		90 hours	g to ECTS)			semester	
			4.5				
1	Types of	courses	conta	ct hours		independent	class size
	elective		63	hours		study	40 students
						27 hours	
2	Prerequ	isites for partici	pation				
	Complet	ed Multimedia S	System				
3	Learning	g outcomes					
	MPCS-IL	0-1					
	Masterir technolo	ng theory and ogy and compute	able to co er science th	onduct stuc nat are appr	lies <sup>r</sup> opr	on the applicat iate for certain p	tion of the latest roblems
	MPCS-IL	0-3					
	Masterir and test	ng theory and be ed computer-ba	eing able to sed solutior	apply engir 1s	neer	ring concepts to p	produce innovative
4	Subject	aims					
	Students	s are able to per	form abstra	ction and d	ata	representation (C	CPL: KK4)
5	Teaching	g methods					
	lectures,	, case study, clas	s discussior	n, presentat	ion,	practice	
6	Assessm	ent methods					
	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment						
7	This mo	dule is used in tl	ne following	g degree pr	ogra	ams as well	
8	Respons	ibility for modu	le				

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

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Prop	Proposal Preparation							
Cours	se Code	Student	Credits	Semeste	r	Frequency		Duration
CCS8	2271	Workload	(accordin	Sem. 2		Even-semeste	r	16 meetings
		60 hours	g to FCTS)					
			2013)					
			5					
1	Types of	courses	conta	ct hours		independent		class size
	compuls	ory	42	hours		40 students		10 students
	18 hours							
2	Prerequ	isites for partici	pation					
3	Learning	goutcomes						
	MPCS-IL	.0-1						
	Masterii	ng theory and	able to co	onduct stud	lies	on the application	tion	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							
	Student	s are able to form	nulate a the	esis proposa	al sy	stematically and	clear	·ly.
5	Teaching methods							
	lectures, case study, class discussion, presentation, practice							
6	Assessm	ent methods						
	assignm	ent, mid-term	examinatio	on, end-tei	rm	examination, p	rojec	t evaluation,
	practica	l-skill assessmen	t					
7	This mo	dule is used in t	he followin	g degree pr	ogra	ams as well		

8	Responsibility for module
9	Other information -

Prop	Proposal Seminar						
Cour	se Code	Student	Credits	Semeste	r Frequency	Duration	
CCS8	1372	Workload	(accordin	Sem. 3	Odd-semeste	r 16 meetings	
		60 hours	g to FCTS)				
			2				
1	Turner		3	at b aa	independent		
L	i ypes of	courses	conta	ct nours	study	class size	
	compuls	ory	42	hours	18 hours	40 students	
2	Duananu				18 110013		
2	Prerequ	isites for partici	pation				
3	Learning	goutcomes					
	MPCS-IL	0-1					
	Masteri	ng theory and	able to co	onduct stud	lies on the applica	tion of the latest	
	technolo	ogy and compute	er science th	hat are app	ropriate for certain p	roblems	
	MPCS-IL	0-2					
	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	s are able to pr	esent prop	osals verba	Illy well and explain	various questions	
	related t	o the research r	naterial tha	t will be ca	ried out clearly and	measurably.	
5	Teachin	g methods					
	lectures, case study, class discussion, presentation, practice						
6	Assessment methods						
	assignment, mid-term examination, end-term examination, project evaluation.						
	practica	l-skill assessmen	t				
7	This mo	dule is used in tl	ne followin	g degree pr	ograms as well		
8	Respons	ibility for modu	le				

9	Other information
	<u>-</u>

Real-	Real-time System							
Cours	se code	student	credits	semeste	r	frequency		duration
CCS8	0344	workload 90 hours	(accordin g to ECTS)	Sem. 2 &	3	Each odd and ev semester	/en	16 meetings
			4.5					
1	Types of	courses	conta	ct hours		independent		class size
	Elective		63	hours		study		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	s are able to exp	lain the bas	ic concepts	and	d terminology of r	eal-	time systems
	Students are able to build a task scheduler using different scheduling policies on multiple systems							
	Students	are able to ana	lyzing timin	g behavior	of t	he system and scl	hedu	uling policy
	Students policies	s are able to disc	cuss the adv	antages an	d di	sadvantages of va	ariou	is scheduling

	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, project evaluation, practical-skill assessment
8	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment This module is used in the following degree programmes as well
8	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment This module is used in the following degree programmes as well
8	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment This module is used in the following degree programmes as well Responsibility for module
8	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment This module is used in the following degree programmes as well Responsibility for module
8 10 11	assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment This module is used in the following degree programmes as well Responsibility for module Other information

Rese	arch Indu	ction				
Cour	se Code	Student	Credits	Semester	r Frequency	Duration
CCS8	1170	Workload	(accordin	Sem. 1	Odd-semeste	r 16 meetings
		60 hours	g to ECTS)			
			3			
1	1 Types of courses		conta	ct hours	independent	class size
	compulsory		42	hours	study	40 students
					18 hours	
2	Prerequ	isites for partici	pation			
3	Learning	; outcomes				
	MPCS-IL	0-1				

	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, 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.

Rese	Research Methodology & Scientific Paper Writing						
Cours UBU8	<b>se code</b> 30001	student workload 90 hours	<b>credits</b> (accordin g to ECTS) 4.5	semeste Sem. 1	each odd- semester	duration 16 meetings	
1     Types of courses     contact hours     independent     class       Compulsory     63 hours     27 hours     40 study       2     Prerequisites for participation				class size 40 students			
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	<ol> <li>Subject aims</li> <li>Students are able to understand the advanced concepts of scientific research.</li> <li>Students are able to do a review of different types of research.</li> <li>Students are able to draft scientific research proposals.</li> </ol>						
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	Respons	sibility for modu	le				
9	Other in 1. Cres Met 2. Cres Five	formation well, John W. da hods Research. I well, John W. 20 Approaches. US	ın Clark, Vic JSA: Sage P )13. Qualita A: Sage Pub	ki L. Plano. 2 ublicatios, li tive Inquiry ilications	2011. Designing and nc. and Research Desigr	Conducting Mixed	

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

Scien	Scientific Publications						
Course Code		Student	Credits	Semeste	r Frequency	Duration	
CCS8	2473	Workload	(accordin	Sem. 4	Even-semest	er 16 meetings	
		60 hours	g to ECTS)				
			3				
1	Types of	courses	conta	ct hours	independent	class size	
-	compuls	ory	12	hours	study	40 students	
	18 hours		40 students				
2	Prerequisites for participation						
3	Learning outcomes						
	MPCS-IL	0-1					
	Mastering theory and able to conduct studies on the application of the latest technology and computer science that are appropriate for certain problems						
	MPCS-IL	0-2					
	Masterir tested re	ng theory and ab esearch products	le to apply in the field	research mo Is of techno	ethodologies to pro logy and computer	duce innovative and 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	g methods					
	lectures,	case study, clas	s discussior	n, presentat	ion, practice		
6	Assessm	ent methods					
	assignmo practical	ent, mid-term -skill assessmen	examinatio t	on, end-te	rm examination,	project evaluation,	
7	This mo	dule is used in th	ne following	g degree pr	ograms as well		

8	Responsibility for module
9	Other information
	-

Smart S	ystem						
Course	code	student	credits	semeste	r frequency	duration	
(CCS81108)		workload 90 hours	(accordin g to ECTS)	Sem. 1	each odd- semester	16 meetings	
			4.5				
1	Types	of courses	conta	ct hours	independent	class size	
	сотр	ulsory	63	hours	study	40 students	
					27 hours		
5	Prere	quisites for part	icipation				
	-						
2	Learn	ing outcomes					
	MPCS	-ILO1					
	Maste techn	ering theory and ology and comp	able to con uter science	duct studies that are ap	s on the application propriate for certai	of the latest n problems	
3	Subje	ct aims					
	1. Si	tudents are able	to apply ty	pes of fuzzy	inference.		
	2. A	ble to understar	nd the conce	ept of classi	fication and fuzzy pa	attern recognition.	
	5. А g	eneralization in	Artificial Ne	ural Networ	rks (ANN).	lance learning and	
	4. A	ble to identify, e	evaluate and	d implement	t ANN in various cas	es.	
	5. A	ble to select	and imple	ement evo	lutionary computir	ig techniques for	
	6. A	ble to hybridize	several tecl	nniques in e	volutionary comput	ing, artificial neural	
	networks, and fuzzy logic for solving complex problems effectively an efficiently.						
4	Teach	ing 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.								

Soft	Software Engineering Modeling								
Course code CCS80348		student workload 60 hours	<b>credits</b> (accordin g to ECTS)	semester Sem. 2 & 3		frequency Each odd and eve semester		duration 16 meetings	
1	Types of	fcourses	3 conta	ct hours		independent		class size	
	Elective		42	42 hours		<b>study</b> 18 hours		40 students	
5	Prerequ	isites for partici	pation						
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, project evaluation, practical-skill assessment
8	This module is used in the following degree programmes as well
10	Responsibility for module
11	Other information
	<ol> <li>Pressman, R.S., 2009. Software Engineering – A Practitioner's Approach. 7th Edition. McGraw-Hill Science.</li> <li>Sommerville, I., 2010. Software Engineering. 9th Edition. AddisonWesley.</li> <li>Vliet, H., 2008. Software Engineering: Principles and Practice. 3rd Edition. Wiley.</li> <li>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.</li> </ol>

Softv	Software Engineering Project Management										
Course code student		credits	semeste	r	r frequency <sup>3</sup> Each odd and even semester		duration				
CCS80347		workload 90 hours	(accordin g to ECTS) 4.5	Sem. 2 & 3			16 meetings				
1	1 Types of courses		conta	contact hours		independent		class size			
	Elective		63	63 hours		study		40 students			

			27 hours						
5	Prerequisites for participat	tion		L					
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 and tested computer-based	g able to apply engir d solutions	eering concepts to p	roduce innovative					
3	Subject aims								
	Students are able to unders management	stand the influence of	of the SDLC model or	n software project					
	Students are able to unders	stand the basic conc	epts of software pro	ject management					
	Students are able to apply planning	project managemen	t techniques in softw	vare project					
4	Teaching methods								
	lectures, case studies, class	discussions							
6	Assessment methods								
	assignment, mid-term exan practical-skill assessment	nination, end-term e	examination, project	evaluation,					
8	This module is used in the	following degree pr	ogrammes as well						
10	Responsibility for module								
11	Other information								
	1. Pressman, R.S., 2009. Sc McGraw-Hill Science.	oftware Engineering	– A Practitioner's App	proach. 7th Edition.					
	<ol> <li>Sommerville, I., 2010. S</li> <li>Vliet, H., 2008. Software</li> <li>Hughes, B., Cotterell, McGraw-Hill.</li> </ol>	oftware Engineering e Engineering: Princi M., 2009. Softwai	9th Edition. Addiso ples and Practice. 3rd Project Manager	nWesley. d Edition. Wiley. nent. 5th Edition.					

Softv	oftware Engineering Quality									
Cours	se code	student workload	credits	semeste	r freq	uency	duration			
CCS8	0245	90 hours	g to ECTS)	Sem. 2	each sem	even- ester	16 meetings			
			4.5							
1	Types of	courses	conta	ct hours	independ	ent	class size			
	Elective		63	hours	study		40 students			
					27 nours					
5	Prerequ	isites for partici	pation							
2	Learning	g outcomes								
	MPCS-IL	01								
	Masterir technolo	ng theory and ab	le to condu er science th	ct studies c nat are appr	n the applicat opriate for ce	tion of the ertain prol	e latest blems			
	MPCS-IL	03								
	Masterir and test	ng theory and be ed computer-ba	ing able to sed solutior	apply engir 1s	eering conce	ots to pro	duce innovative			
3	Subject	aims								
	Students	s are able to und	erstand the	basic tech	niques of soft	ware test	ing and analysis			
	Students topics te embedd	s are able to con esting and analys ed, game, mobil	duct literatu is of emerg e)	ure studies ing complex	of English-lan ‹ software sys	guage par tems (e.g	pers for current g. real time,			
	Students topics	s are able to pres	senting the	results of li	terature studi	es condu	cted on certain			
	Students	are able to ider	ntify researc	ch opportur	iities on speci	fic topics	presented			
4	Teaching	g methods								
	lectures,	, case studies, cla	ass discussio	ons						
6	Assessm	ent methods								
	assignm practical	ent, mid-term ex I-skill assessmen	amination, t	end-term e	xamination, p	oroject ev	aluation,			

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

Softv	Software Engineering								
Course code (CCS81107)		<b>student</b> workload 90 hours	credits (accordin g to ECTS) 4.5	semeste Sem. 1	r	frequency each odd- semester	duration 16 meetings		
1	Types of courses compulsory		conta 63	contact hours 63 hours		<b>ependent</b> <b>study</b> 7 hours	class size 40 students		
5	Prerequ -	isites for partici	pation						
2	Learning	g 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, 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
	<ol> <li>Pressman, R.S., 2009. Software Engineering – A Practitioner's Approach. 7<sup>th</sup> Edition. McGraw-Hill Science.</li> <li>Sommarrille, L. 2010. Software Engineering. 0th Edition. Addison Weslaw</li> </ol>
	2. Sommervine, I., 2010. Software Engineering. Sth Edition. Addison Wesley.
	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.

Speci	Special Topics in Computational Intelligence								
Cours	se Code	Student	Credits	Semeste	r	Frequency		Duration	
CCS8	0222	Workload	(accordin	Sem. 2/3	3	Even-semester	or	16 meetings	
		90 hours	ECTS)			odd-semeste	r		
			4,5						
1	Types of	courses	conta	ct hours		independent		class size	
	elective		63	hours		study		40 students	
						27 hours			
2	Prerequ	isites for partici	pation						
	-								
3	Learning	g outcomes							
	MPCS-IL	01							
	Masterir	ng theory and	able to co	onduct stud	lies	on the applica	tion	of the latest	
	technolo	ogy and compute	er science th	nat are appi	ropr	iate for certain p	robl	ems	
	MPCS-IL	03							
	Masterir	ng theory and be ed computer-bay	ing able to	apply engir	neer	ring concepts to p	orod	uce innovative	
4	Subject			15					
-	Studente	s are able to und	erstand and	l ha ahla to i	mn	lement the latest	tock	niques related	
	to comp	utational compu	iting.		mp		leci	inquestelateu	
5	Teaching	g methods							
	lectures	, case study, clas	s discussior	n, presentat	ion				
6	Assessm	ent methods							
	assignm	ent, mid-term	examinatio	on, end-te	rm	examination, p	roje	ct evaluation,	
	practical	-skill assessmen	t						
7	This mo	dule is used in th	ne following	g degree pr	ogra	ams as well			
8	Respons	ibility for modu	le						
9	Other in	formation							
	Russell,	S., Norvig, P., 200	03. Artificial	Intelligence	e: A	Modern Approac	h. 3ı	rd Edition. New	
	Jeisey. P								

Special Topics in Decision Support System									
Cour	se Code	Student	Credits	Semeste	er	Frequency		Duration	
CCS8	0323	Workload	(accordin	Sem. 2/3	3	Even-semester	or	16 meetings	
		90 hours	ECTS)			odd-semeste	r		
			4,5						
1	Types of	f courses	conta	ct hours		independent		class size	
	elective		63	hours		study	4	40 students	
						27 hours			
2	Prerequ	isites for partici	pation						
	-								
3	Learning	goutcomes							
	MPCS-IL	01							
	Masterir technolo	ng theory and	able to co er science th	onduct stud nat are appl	dies ropr	on the applica riate for certain p	tion roble	of the latest ems	
	MPCS-IL	03							
	Masterii	ng theory and be	eing able to	apply engi	nee	ring concepts to <sub>l</sub>	orodi	uce innovative	
	and test	ed computer-ba	sed solutior	าร					
4	Subject	aims							
	Student	s are able to und	lerstand the	e basics of D	DSS (	design and develo	opme	ent.	
	Students	s are able to ado	pt current a	and future [	DSS	implementation	chall	enges.	
5	Teaching	g methods							
	lectures	, case study, clas	s discussior	n, presentat	tion				
6	Assessm	ent methods							
	assignm practica	ent, mid-term I-skill assessmen	examinatio t	on, end-te	rm	examination, p	rojeo	ct evaluation,	
7	This mo	dule is used in tl	he following	g degree pr	ogr	ams as well			
8	Respons	ibility for modu	le						
9	Other in	formation							

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 (accordin g to ECTS) 4.5	Semester Sem. 2 & 3		Frequency Odd and even- semester		<b>Duration</b> 16 meetings	
1	1 Types of courses elective		conta 63	act hours hours		independent study 27 hours	4	<b>class size</b> 40 students	
2	Prerequ	isites for partici	pation						
3	Learning outcomes								
	MPCS-IL	0-1							
	Masterir technolo	ng theory and ogy and compute	able to co er science th	nduct stuc	dies ropr	on the application on the opplication of the opplic	tion roble	of the latest ems	
	MPCS-IL	0-3							
	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 application					e applications.			
	Students topics.	s are able to pr	esent the r	results of li	tera	ature studies con	duct	ted on certain	

	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		Student	Credits	Semeste	r Frequency	Duration		
CCS80338		Workload 90 hours	(accordin g to ECTS) 3	Smt 2/3	each odd- semester/ each even semester	16 meetings		
1	1 Types of courses Elective (study program level)		<b>conta</b> <i>m</i> 63	<b>ct hours</b> hours	independent study 27 hours	<b>class size</b> 40 students		
2	Prerequisites for participation							
3	Learning	goutcomes						
	MPCS-IL	01						

	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
٩	Other information
5	
	International Journal in Remote Sensing & GIS, and Its Applications.

Special Topics in Mobile Application									
Course Code CCS80354		Student Workload 90 hours	Credits (accordin g to ECTS)	Semester Sem. 2 & 3		Frequency Odd and even- semester	Duration	n Igs	
			4.5						
1	Types of	courses	conta	ct hours	in	ndependent	class size		
	elective		63	63 hours		study	40 students		
						27 hours			
2	Prerequ	isites for partici	pation						

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, prozet 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								
	7. Satva 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									
Cour	se Code	Student	Credits	Semeste	r Frequei	Frequency			
CCS8	0334	Workload	(accordin	Sem. 2 /	3 Even-seme	ster or	16 meetings		
		90 hours	g to ECTS)		odd-seme	ester			
			4.5						
1	Types of	f courses	conta	ct hours	independent	indopondont			
-	Floctivo		62	hours	study		40 students		
	LIECTIVE		05	110013	27 hours		40 students		
2	Prerequ	isites for partici	pation						
	-								
3	Learning	goutcomes							
	MPCS-IL	01							
	Masterir	ng theory and	able to co	onduct stud	lies on the app	lication	of the latest		
	technolo	ogy and compute	er science th	nat are app	opriate for certa	in prob	lems		
	MPCS-ILO3								
	Masteri	ng theory and be	eing able to	apply engi	neering concepts	to proc	duce innovative		
	and test	ed computer-ba	sed solutior	าร					
4	Subject aims								
	Students are able to understand network traffic engineering.								
	Students	s are able to und	erstand ho	w to monito	or network traffic	2.			
	Students	s are able to ider	ntify and an	alyze probl	ems in network t	raffic.			
5	Teaching	g methods							
	Lectures	s, case study, cla	ss discussio	n, presenta	tion				
6	Assessm	ent methods							
	Assignment, mid-term examination, end-term examination, project evaluation, practical-skill assessment								
7	This mo	dule is used in tl	he followin	g degree pr	ograms as well				
8	Responsibility for module								
9	Other in	formation							
- 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", 6<sup>th</sup> Ed., Pearson/Addison.
- 3. Peterson, L. L., & Davie, B. S. 2011. *Computer Networks: A Systems Approach*. 5<sup>th</sup> Ed., Elsevier.

Speci	Special Topics in Programmable Networks								
Cours	se Code	Student	Credits	Semeste	er	Frequency		Duration	
CCS80335		Workload 90 hours	(accordin g to ECTS)	Smt 2/3		each odd- semester/		16 meetings	
			3			semester			
1	Types of	courses	conta	ct hours		independent	class size		
	Elective	(study prograi	m 63	hours		study		40 students	
	level)					27 hours			
2	Prerequ	isites for partici	pation						
3	Learning	g outcomes							
	MPCS-ILO1								
	Mastering theory and able to conduct studies on the application of the lates technology and computer science that are appropriate for certain problems					of the latest ems			
	MPCS-IL	03							
	Masterir and test	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	g 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					
	<ol> <li>Sezer, S., Scott-Hayward, S., Chouhan, P. K., Fraser, B., Lake, D., Finnegan, J., &amp; Rao, N. 2013. Are We Ready for SDN? Implementation Challenges for Software- Defined Networks. Communications Magazine, IEEE, 51(7), 36-43.</li> </ol>					
	<ol> <li>G.A.A. Santana, "Data Center Virtualization Fundamentals," Cisco Press, 2013, ISBN:1587143240.</li> </ol>					
	<ol> <li>K. Hwang, J. Dongarra, G.C. Fox, "Distributed and Cloud Computing," Morgan Kaufmann 2011, ISBN:0123858801.</li> </ol>					
	<ol> <li>Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective," CRC Press, 2012, ISBN:1439892997</li> </ol>					

Special Topics in Software Engineering								
Course code		student	credits	semeste	r	frequency	duration	
CCS80350		workload	(accordin	Sem. 2		each even-	16 meetings	
		120 hours	g to ECTS)			semester		
			6					
1	1 Types of courses			contact hours		ependent	class size	
	Elective		84	84 hours		study	40 students	
						5 hours		
5	5 Prerequisites for participation							
2	Learning	; outcomes						
	MPCS-IL	01						

	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	Pernonsibility for modulo
10	Responsibility for module
11	Other information
	<ol> <li>Pressman, R.S., 2009. Software Engineering – A Practitioner's Approach. 7th Edition. McGraw-Hill Science.</li> <li>Sommerville, I., 2010. Software Engineering. 9th Edition. AddisonWesley.</li> <li>Vliet, H., 2008. Software Engineering: Principles and Practice. 3rd Edition. Wiley.</li> <li>Journal of the ACM Transactions on Software Engineering and Methodology (TOSEM). ACM.</li> </ol>
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Special Topics in User Experience & Information System								
Cours	se Code	Student	Credits	Semeste	r	Frequency	C	Duration
CCS8	0341	Workload	(accordin	Smt 2/3		each odd-	16	meetings
		90 hours	g to ECTS)			semester/		
			3			each even		
						semester		
1	Types of	courses	conta	ct hours		independent	cla	ss size
	Elective	(study program	m 63	hours		study	40 st	tudents
	level)					27 hours		
2	Prerequ	isites for partici	pation					
3	Learning	g outcomes						
	MPCS-IL	01						
	Masterir technolo	ng theory and	able to co	onduct stud	lies	on the application	tion of	the latest
							innovativo	
	and test	ed computer-ba	sed solution	apply eligit is	ICC		Jource	miovative
4	Subject	aims						
	Students users ex	s are able to und perience and inf	derstand an ormation sy	d explain cu ystems.	urre	ent problems/app	roaches	related to
5	Teaching methods							
	lectures,	, case study, clas	s discussior	n, presentat	ion			
6	Assessm	ent methods						
	assignm	ent, mid-term	examinatio	on, end-tei	rm	examination, p	roject e	evaluation,
	practical	-skill assessmen	t					
7	This mo	dule is used in tl	he followin	g degree pr	ogr	ams as well		
8	Respons	ibility for modu	le					
9	Other in	formation						
	1. Lauc Pear	don, K. C. & Lauc rson.	lon, J. P., 20	)14. Manage	eme	ent Information S <sup>.</sup>	ystems. 2	13th ed.

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.

Thesi	Thesis Exam							
Course Code CCS82473		Student Workload 150 hours	Credits (accordin g to ECTS)	Semeste Sem. 4	r <b>F</b> Eve	<b>Frequency</b> Even-semester		Duration 16 meetings
1	L Types of courses compulsory		3 conta 105	<b>ct hours</b> hours	indep st 45 l	dependent study 45 hours		<b>class size</b> 40 students
2	Prerequisites for participation							
3	Learning outcomes							
	MPCS-ILO-1							
	Mastering theory and able to conduct studies on the application of the late technology and computer science that are appropriate for certain problems			of the latest ems				
	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					innovative and ce		
	MPCS-IL	0-3						
	Mastering theory and being able to apply engineering concepts to produce innovative and tested computer-based solutions					uce innovative		
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, project evaluation,
7	This module is used in the following degree programs as well
8	Responsibility for module
9	Other information -