GEM project

Survey report: exploration of geospatial course supply and demand in Central Asia (Kz-Kg-Tj)

Master in Geoinformatics: Managing Energy, Resources, Environment. Survey results on current course offers, industry demand and potential GEM teachers.

Work package 1: Review undergraduate programmes, industry demand and faculty potential.

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Introduction

At the start of the GEM project (MSc Geoinformatics: Managing Energy, Resources, Environment), three questionnaires were held in Central Asia in order to position the future GEM curriculum well within the current supply of spatial educational programmes and courses, as well as to meet the demands from industry regarding end qualifications of the future GEM master alumni. The aim of this report is to formulate a clear basis for curriculum development. Three surveys have been carried out in the framework of Work package 1 ("Review undergraduate programmes, industry demand and faculty potential"): a) on the current spatial course offers, b) on industry demand and c) on potential GEM teachers. The work package consisted of two elements:

a. Design Survey - addressing academic perspectives, industry requirements and job prospects as well as linkages to a range of application disciplines and including an analysis of prerequisite knowledge provides the foundation for curriculum design. The project adopted a service-based approach starting with a demand analysis of curricular requirements by online questionnaires and interviews. The following aspects are considered:
     • A survey and needs analysis concerning the design of a new GEM curriculum among the scientific/academic staff of Central Asian partner institutions.
     • The status-quo concerning knowledge and skills of undergraduate students will be surveyed using questionnaires, interviews and skill tests.
     • A survey has been carried out amongst representatives of the Industry (employment demand sector).
b. Review of present curricula of Central Asian partner institutions and existing International model curricula - in order to guarantee a sustained success and ongoing development of resources, delivery of courses and ongoing qualification of professionals in GEM.

The questionnaires were held from February – May 2011, with a total number of 269 respondents, as explained in the table below (table 1).

Table 1: Number of respondents GEM questionnaires, 2011

	Current course offerings	Industry demand	Potential teachers
Kyrgyzstan	38	41	31
Kazakhstan	30	35	32
Tajikistan	30	22	10
Total	**98**	**98**	**73**

The online questionnaires were designed by all GEM project partners, and paper versions of the questionnaire were prepared and translated into Russian by the University of Central Asia (Department Knowledge Management and Development). Several problems caused delays in getting the required information from Tajikistan, amongst others the poor existing internet connections as well as language issues. Therefore not all data from Tajikistan could be included in the report.

This report consists of four chapters: the results of the questionnaire of the current course offerings (including an overview of the general academic student qualifications as perceived by their teachers, with a focus on the English language and computer skills; the opinion of the teachers regarding the GEM curriculum), the results from the questionnaire of the industry demands (including general information on the firms and organizations, the use of GIS by these firms and organizations, possibilities for internships for GEM students as well as employment possibilities,, and GEM curriculum needs assessments) and the questionnaire from the potential teachers (including general information of the potential teachers, experiences with students, GIS training needs and interests, and GIS teaching experience). The conclusion summarizes the main findings. Subsequently, in the annexes an overview is given of the courses the respondents are teaching.

1. Current spatial courses supply

Introduction

Aim of this questionnaire is to explore the field of current course offerings in the field of Spatial Sciences in the three Central Asian republics, in order to position GEM curriculum well within this current supply of educational programmes and courses. Spatial Sciences is to be understood in a wider sense, including all digital geospatial concepts, methods and technologies, including cartography, digital mapping etc. Teachers lecturing in the field of Spatial Sciences were asked to fill in the questionnaire, which would give insights into the curriculum of the new international educational master programme in Geoinformatics. At the start of the project it is important to learn from lecturer's experiences involved in geography and / or GIS teaching and training, and to be informed about their views on student qualifications (amongst others also English language skills and general computer skills) and end terms (crucial topics) this program should have.

This chapter consists of five parts: it starts with general information on the respondents, than an overview of the general academic student qualifications as perceived by their teachers, with a focus on the English language and computer skills. Than the opinion of the teachers regarding the GEM curriculum will be given including suggestions for additional topics to the curriculum. Subsequently, an overview will be presented of the courses the respondents are teaching. A detailed over view of the courses is presented in the Annex A of this report. The conclusion summarizes the main findings.

The questionnaire was held from February – May 2011 in Kyrgyzstan (38 respondents), Kazakhstan (30 respondents), and Tajikistan (30 respondents), with a total of 98 respondents. Table 1A provides on overview of the background of the respondents. Of the respondents, 19% were filled in directly by the respondents via the internet (in Kazakhstan 11 of the 30 respondents), and 81% were filled in on paper copies of the questionnaire, and filled in via the internet by the GEM project members.

General information

Table 1A, Overview background respondents, potential GEM teachers questionnaire, 2011					
Country	University	Faculty	Study program	#respondents	#courses
Kazakhstan	Academy of Architecture and Construction	Faculty of Building Technologies, Infrastructure and Management	geodesy and cartography	3	3
	KazNU	Geography faculty	Physical Geography	1	1
			Tourism	2	0
			Geomorphology and cartography	4	2
	Korkyt Ata Kyzylorda State University	Phisics and Mathematics	Informational technologies	12	12
		Politechnical	Water management	6	0
		Water industry	Water industry	1	0

	South Kazakhstan university	Geographical faculty	Geography	1	0
Kyrgyzstan	College of Architecture in the management of construction	Construction and exploitation of buildings and facilities	Construction and exploitation of buildings and facilities	1	1
	Eurasian Institute	Law and economics	Accounting and Audit	1	1
	Institute of mining and mountain technologies	Mining Metalurgical	Geodesy and main survey	1	1
	Issyk-Kul State University	Natural sciences	Geography	3	5
		Environment management and tourism	Tourism	1	0
	Kyrgyz National Agrarian University	Natural resource management	Geodesy and cartography	1	2
			land management	1	0
	Kyrgyz State Pedagogical University	Geography, Ecology and Tourism	Phisical geography	2	4
			Geography	2	4
			Ecology of Nature management	1	2
			Economical, Social and Political Geography	1	1
	Kyrgyz State Technical University	Information technology	Software Engineering	1	1
			Rescue in emergency situations and ecology	1	1
	Kyrgyz-Russian Slavic University	Architecture,Design and Construction	Hydraulic Ingineering and Water Resources	1	1
	Naryn State University	Agrarian-Technical	Ecology	2	2
	Osh State University	Natural Sciences and Geography	Natural sciences	1	1
			Physical Geography and Applied Geodesy	2	2
			Geography	1	1
	Osh Technological University	Cybernetics and Information Technology	Software and automated systems	4	8
		Faculty of Energy	Electrical Energy	1	2
		Technology and Nature Maintenence	Geology	4	5
			Ecology and Environmental Protection	1	1
	Talas State University	Natural science and pedagogy	General biology and pedagogy	3	5
Tajikistan	Tajik Agrarian University	Administration	Administration	1	0
		Hydromelioration	Geodesy and	3	2

		Geoinformatics			
			Land management	5	2
	Agronomy	Agronomy		4	0
	Economy	Economy		1	0
	Forestry	Forestry		1	1
RTSU	Geography	Geography		1	0
Tajik state Pedagogical University	Geography	Geography and tourism		4	1
Tajik Technikal University	Geography	Geography		1	0
	Technology	Technology		2	0

General academic student qualifications:

English language skills are a key issue for the success of the GEM curriculum. Table 1B provides an overview of the English language skills, regarding speaking, reading and writing. Teachers were asked to assess the highest English language skills of their average students. In their view, the majority of their students could at most have a simple conversation in English (63% of the respondents), and 13% indicated their students could follow an English taught lecture. Just one respondent said that her/his students could actively participate in an academic conversation.

The estimated reading skills of their average students are in line with the estimated low conversation skills (table 1B). The majority of their students could at most read basic English (60% of the respondents), and 16% indicated their students could read book chapters. None of the respondents indicated that her/his students could read scientific papers.

As well, the writing skills in the English language are low. The majority of their students (51%) can only write informal English in an email; 15% is expected to be able to write English tutor assessed assignments, and just one respondent has indicated that her/his students can write scientific English.

Table 1B Estimated highest level English language skills average students, spatial education questionnaire, GEM 2011					
Conversation skills	Kazakhstan	Kyrgyzstan	Tajikistan	total	%
can actively participate in academic conversation	0	1	0	1	1
can follow English lectures	4	8	1	13	13
can follow English news on television/radio	5	1	10	16	16
can have a simple informal conversation	21	24	17	62	63
none	0	4	2	6	6
Reading skills	Kazakhstan	Kyrgyzstan	Tajikistan	total	%
can read scientific papers	0	0	0	0	0
can read book chapters	5	9	2	16	16
can read newspaper article	4	1	13	18	18
can read basic English	21	26	13	60	61
None	0	2	2	4	4

Writing skills	Kazakhstan	Kyrgyzstan	Tajikistan	total	%
can write scientific English	0	1	0	1	1
can write English tutor assessed assignments	3	9	3	15	15
can write a formal letter in English	7	4	14	25	26
have an informal email correspondence in English	20	20	11	51	52
none	0	4	2	6	6

Sometimes, the teachers use English learning materials (literature) in their course (72%). A minority often uses English materials (8%), and 19% never uses English materials (table 1C). In Tajikistan one third of the respondents said their university offers English language training, in Kazakhstan, half of the respondents said that their university offers English language training, whereas in Kyrgyzstan almost all respondents said that their university offers this type of training.

Table 1C Use of English material, spatial education questionnaire, GEM 2011					
Use English material	Kazakhstan	Kyrgyzstan	Tajikistan	total	%
often	2	4	2	8	8
sometimes	26	22	23	71	72
never	2	12	5	19	19

In conclusion, English language skills of the average students *in all three countries* score overall very low (reading, conversation as well as writing), according to their teachers.

Based on this information, it would be advisable for the GEM project to include English language training in the curriculum, or offer the possibility of English training, before admittance into the GEM programme as some sort of premaster training. Without identifying specific possibilities for such a premaster training, we fear that too few students would qualify for the GEM master programme.

The second item of the general student qualifications concerned the _computer literacy_ of the students. In a computer orientated master programme as the GEM curriculum, it is essential know more about access of students to computers, the internet and the general computer literacy of potential students.

How do you rate the computer literacy of your best 10% students?

Of their best students, 68% uses standard software or less, 23% of the respondents said that their best students use application software in GIS, and 8% (with Kirghizstan slightly overrepresented) can programme (see table 1D).

Table 1D Computer literacy students, spatial education questionnaire, GEM 2011					
Computer literacy	Kazakhstan	Kyrgyzstan	Tajikistan	total	percentage
can program	0	7	1	8	8
uses application software in GIS	10	9	4	23	23
uses standard office software or less	20	22	25	67	68

Which computer programs do your students generally use during their studies? (more than one answer possible).

Most students in Kyrgyzstan use Office software (mentioned 34 times), and GIS software and statistical software were each mentioned 10 to 11 times. In Kazachstan "other software" has been mentioned 35 times, consisting mainly of AutoCAD (18 x) and Credo (17 x) software, and Office software and GIS software considerably less (9 to 10 times mentioned). See table 1E.

Table 1E Computer software use of students, spatial education questionnaire, GEM 2011					
Student software	Kazakhstan	Kyrgyzstan	Tajikistan	total	% "Yes"
office software	9	34	28	71	72
GIS software	10	11	3	24	24
statistical software	1	10	1	12	12
other	35	5	2	42	43
total	**55**	**60**	**34**	**149**	*****

* 72 % "Yes": 72% of the respondents indicated that students use office software.

Table 1F shows the estimates by the teacher of the access of students to a computer at home, and internet access at home. In Kazakhstan, teachers estimated that students have relatively good access to computers (55%) as well as internet access (36%) at home. In Kyrgyzstan, the situation is less favorable, with 26% of the students having computer access at home, and only 15% have internet connection (teacher estimation). In Tajikistan 12% of the students has a PC at home and 4% does have internet access at home.

Table 1F Student computer and internet access at home in %, spatial education questionnaire, GEM 2011				
Access at home	Kazakhstan %	Kyrgyzstan %	Tajikistan	Average %
Percentage with PC at home	55	26	12	30
Percentage with internet access at home	36	15	4	18

It can be concluded that most of the students have basic knowledge of Office software. Access to computers and internet at home by students, is better in Kazakhstan than in Kyrgyzstan and Tajikistan. Overall, it is recommended that the GEM project takes into account the actual non optimal computer infrastructure for the GEM programme, and must take care of facilitating students regarding their access to computers and upgrading their software skills so this will not hamper their study pace and can finalize the programme within the planned two years.

GEM curriculum assessment

The teachers were asked to indicate the importance for each of the 9 modules planned in the GEM curriculum. Table 1G shows the relative importance of each module per country. All respondents indicated that almost all modules are either "very important" or 'important', so not too much importance needs to be given to the relative importance of each of the curriculum topics. It is noticeable that relatively many respondents in Kazakhstan indicated that Remote Sensing is not important (esp answers from Kyzylorda).

Table 1G Importance of GEM curriculum topics per country, spatial education questionnaire, GEM 2011			
Top to low score	Kyrgyzstan	Kazakhstan	Tajikistan
1	Geospatial environmental management	Data models	Data models
2	Geospatial management of resources	Geospatial management of resources	Data acquisition and data integration
3	Applied cartography	Applied cartography	Geodatabase, SDI
4	Geodatabase, SDI	Geodatabase, SDI	Applied cartography
5	Data models	Project management	Spatial analysis
6	Spatial analysis	Spatial analysis	Remote sensing
7	Remote sensing	Geospatial environmental management	Geospatial environmental management
8	Data acquisition and data integration	Data acquisition and data integration	Geospatial management of resources
9	Project management	Remote sensing	Project management

In Kazakhstan only four respondents suggested to include other topics to be included in the curriculum: assessment of the environment (in general, and specifically in the pre-aral sea region), GIS in Melioration, and the Management of water infrastructure and the rational use of water resources. The Kyrgyz respondents suggest the following curriculum additions:

- About the geographical population and use of economic and social geography of the world
- Application development, GIS in geological exploration
- Application in interdisciplinary structures
- Application management Spatial statistics
- Applied cartography, Remote sensing, Geospatial management of resources
- Applied Programming Graphical Modules
- Customization   Computer Simulation
- Design prospecting, Satellite navigating equipments
- Geo-Economics
- Geo-Physical methods for useful search. Geo-cartography. Geo-Chemistry. Mathematical methods of geology.
- GIS applications in socio-economic development, GIS for business
- GIS related to energy. Modules of the effect of Electrical systems on the Environmental Management.
- Graphical modules
- Seismology in KR. Scientific and practical information in the study of the biosphere and the ozone layer.
- Use of the geoinformation for effective and rational injection of agriculture, and also the help in an effective utilisation of recreational resources
- Using GIS for environmental protection

At the moment of writing this report no data was available for Tajikistan.

Inventory of geospatial courses

In the annex A[1] a complete overview is given of all 71 courses the respondents are teaching, with objectives and learning outcomes for each course, keywords, entry requirements, number of students, study hours per course and language of instruction, language of the materials used during the course and computer software. Also 13 teachers indicated that they did not teach a GIS related course during the last three years. In total 2690 students participates in these courses: 33 courses with less than 20 students, 12 courses of 20 to 50 students, 11 courses with 50 to 100 students and 6 courses with more than 100 students.

For Kazakhstan, information has been collected about 11 'spatial' courses, of which 10 are at the BSc level. These courses are shown in table 1H.

Table 1H Spatial courses Kazakhstan, spatial education questionnaire, GEM 2011	
BSc	Name of the course
Bachelor in architecture and building	architecture and building
Bachelor in computing and software	computing and software
Bachelor in Geodesy	digital cartography
Bachelor in Geography	GIS in geomorphology Automatic cartography methods GIS in Physical Geography
Bachelor in informational technologies	informational technologies
Bachelor in water resources management	water resources

It is noticeable that the same course has been filled in with exactly the same information: architecture and building (4x), computing and software (3x), digital cartography (2x), informational technologies (2x), and water resources (3x). This phenomenon can maybe be explained by the fact that these courses are given by more than one lecturer. It limits the validity of the outcomes because the number of courses and therefore the number of students involved is also limited.

For Kirgizstan, information has been collected about 52 'spatial' courses, of which 18 are at the BSc level, 19 at the master level, and 15 "other" (see table 1i). This latter category refers to "degree" programmes.

Table 1.i Spatial courses Kyrgyzstan, spatial education questionnaire, GEM 2011	
BSc	Name of the course
Bachelor in Ecology	Ecological mapping GIS in Ecology GIS Geodesy with Cartography
Bachelor in Geography	GIS Innovation Technology in Geography Gis in Ecology Economic Geography Geographical Analysis Geography
Bachelor in Geology	Topography
Bachelor in GIS technology	GIS technology in emergency situation field

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[1] no data was available for Tajikistan while writing this report

Bachelor in physical geography	Topography with geodesy bases, GIS
Bachelor in Tourism	GIS
Specialist (Bachelor) in Water management	GIS and monitoring of water resource
Bachelor in Software Engineering	Special Course GIS and Customization
Bachelor in Geodesy	the higher geodesy, photogrametry Applied geodesy
MSc	**Name of the course**
Degree specialist in Electrical Energy	Electro-Energical Stations
Degree specialist in computer programming	Technician Software technology
Degree Specialist in Geology	GSRM
Degree Specialist in Mountain works.	DMW
Degree Specialists for Engineering Geolology	DEG
Degree specialists in Technics and exploitation	TEG
Methods of space researches	UNKNOWN
Master in Ecology	GIS in ecology IT Specialists
Master in Geodesy and Geoinformatics	Cartography, GIS, Topographical bases of a geodesy
Master in Geology, Electrical Engineering	Geological Exploitation, Electrical Technition
Master in Power Supply	Power Supply
Master of science	Rational use of natural resources in KR Methods of geographical research
Programming engineer	Software Technology
Other	**Name of the course**
Degree specialist in Environmental Protection	Basic concepts of GIS in Ecology
Degree specialist in Geography	Geoinformation systems Cartography Physical Geography Issues
Degree specialist in programming	Technician
Degree specialist on geology, geodesy	Geological exploration and mineral survey
UNKNOWN higher education	geographic population Ecology Tourism Economics - Social Geography Cartography
Higher professional education in geography	Hydrology

For Tajikistan information has been collected for 11 spatial courses of which 10 are taught at the bachelor level, related to Geography, Geodesy, Mathematics and land management.

Do you use English language software for this course?
Half of the respondents has indicated to use English software during the course (see table 1J). The use of the English language as instruction language is limited (4% of the answers: Bachelor of Geography, course "Geography"; Bachelor in Software Engineering, "Special Course GIS and Customization"), predominantly instruction is in Russian or in the Kazakh, Kyrgyz or Tajik language (table 1K).

Table 1J Teachers' use of English software, spatial education questionnaire, GEM 2011					
English software	Kazakhstan	Kyrgyzstan	Tajikistan	total	%
Yes	6	30	6	42	52
No	12	22	5	39	48
Don't know	0	0	0	0	0

Table 1K Teachers' language of instruction, spatial education questionnaire, GEM 2011				
Language of instruction	Kazakhstan	Kyrgyzstan	Tajikistan	%
English	0	3	0	4
Russian	7	35	6	59
other	11	14	5	37

Materials are mostly in Russian and a minor part is in English. All courses use Office software, some use GIS and statistical software is rarely used.

Regarding the use of spatial software, most respondents in Kazakhstan indicate that they use AutoCAD and CREDO (see table 1.L, no data on Tajikistan).

Table 1.L Student software, spatial education questionnaire, GEM 2011			
software	Kazakhstan	Kyrgyzstan	total
AutoCAD	18	0	18
AutoCad, Credo Mix,Geocom	0	1	1
Autocard	0	1	1
C++, MatLab, Photoshop, Corel Draw	0	1	1
CREDO	17	0	17
graphical software	0	1	1
Testing system	0	1	1

Summary and conclusion

Aim of this questionnaire is to explore the field of current course offerings in the field of Spatial Sciences in the three Central Asian republics, in order to position GEM curriculum well within this current supply of educational programmes and courses. The questionnaire was held from February – May 2011 in Kyrgyzstan (38 respondents), Kazakhstan (30 respondents), and Tajikistan (30 respondents), with a total of 98 respondents. Of the respondents, 19% were filled in directly by the respondents via the internet (in Kazakhstan 11 of the 30 respondents), and 81% were filled in on paper copies of the questionnaire, and filled in via the internet by the GEM project members.

Some information on the same courses has been registered several times in the database. Maybe these courses are given by more than one lecturer, but it limits the validity of the outcomes because the number of courses and therefore the number of students (3288) involved is also limited.

We assessed the following academic student qualifications:

1. English language skills. English language skills of the average students *in both countries* score overall very low (reading, conversation as well as writing), according to their teachers. In Kyrgyzstan, their universities do offer English language training, and in Kazakhstan almost half of the respondents indicated that these course are offered by their university.
Based on this information, it would be advisable for the GEM project to include English language training in the curriculum, or offer the possibility of English training, before admittance into the GEM programme as some sort of premaster training. Without identifying specific possibilities for

such a premaster training, we fear that too few students would qualify for the GEM master programme.

2. Computer literacy and access. Most of the students have basic knowledge of Office software. Access to computers and internet at home by students, is better in Kazakhstan than in Kyrgyzstan. Overall, it is recommended that the GEM project takes into account the actual non optimal computer infrastructure for the GEM programme, and must take care of facilitating students regarding their access to computers and upgrading their software skills so this will not hamper their study pace and can finalize the programme within the planned two years

GEM curriculum assessment: The teachers were asked to indicate the importance for each of the 9 modules planned in the GEM curriculum. All respondents indicated that almost all modules are either "very important" or 'important", so not too much importance needs to be given to the relative importance of each of the curriculum topics.

Several suggestions have been made for additions to the proposed curriculum modules. In Kazakhstan e.g. assessment of the environment (in general, and specifically in the pre-aral sea region), and water resources. The Kyrgyz respondents suggest the following curriculum additions: amongst others inter-disciplinary applications, geological exploration, computer simulations, geo-economics, energy appli-cations, environmental protection, applications in agriculture and tourism, earth science applications (seismology, geology, physical geography, GPS, Geospatial management of resources.

In the Annex a complete overview is given of all 71 courses the respondents are teaching, with objectives and learning outcomes for each course, keywords, entry requirements, number of students, study hours per course and language of instruction, language of the materials used during the course and computer software. Most of these course have student numbers up to 20 students. For Kazakhstan, information has been collected about 11 'spatial' courses, of which 10 are at the BSc level. These courses are given in Bachelor programmes of architecture and building, computing and software, informational technologies, geodesy, geography and water resources management. For Kirghizstan, information has been collected about 52 'spatial' courses, of which 18 are at the BSc level, 19 at the master level, and 15 "other" (see table 8). The course are taught in Bachelor programmes such as Bachelor in Ecology, Bachelor in Geography, Geology, Geodesy, Bachelor in GIS technology, physical geography, Tourism, Water management and Software Engineering. At the master level spatial courses are taught e.g.i n the following programmes: Electrical Energy, computer programming, Geology, Mountain works, Engineering Geololog ,Technics and exploitation, Ecology, Geodes, and Geoinformatics, Geology, Electrical Engineering and Power Supply. The category "other" refers to courses in degree specialist programmes, such as: Environmental Protection, Geography, geology, geodesy, programming or higher professional education in geography. For Tajikistan information has been collected for 11 spatial courses of which 10 are taught at the bachelor level, related to Geography, Geodesy, Mathematics and land management.

English is hardly used during the courses: only two courses are taught in English, and half of the respondents has indicated to use English software during the course. Predominantly instruction is in Russian or in the Kazakh, Kyrgyz or Tajik language.

2. Demands from Industry

Introduction

Aim of the questionnaire is to develop the best fit between the masters curriculum and the market needs, as a means to generate insights into the best set up curriculum of the new international educational master programme in Geoinformatics. This questionnaire is targeted at firms and organisations working in the field of GIS. GIS is to be understood in a wider sense, including all digital geospatial concepts, methods and technologies, including cartography, digital mapping, etc. These firms and organizations were asked to fill in the questionnaire, which would give. At the start of this project it is important to know beforehand the views of firms and organizations on the student qualifications and the end terms this program should have.

This chapter consists of five parts: general information about the firms and organization of the respondents, the use of GIS by these firms and organizations, possibilities for internships for GEM students and Gem curriculum needs.

The questionnaire was held from February – May 2011 in Kyrgyzstan (41 respondents), Kazakhstan (35 respondents), and Tajikistan (22 respondents). Of the respondents, 45% were filled in directly by the respondents via the internet (predominantly in Kazakhstan), and 55% were filled in on paper copies of the questionnaire, and filled in via the internet by the GEM project members.

General information

In Kazakhstan, 35 questionnaires were filled in,. In Kyrgyzstan, 41 questionnaires were filled in, in Tajikistan 22. Respondents come from a broad range of different institutes, as indicated in tables 2A, 2B and 2C below.

Table 2A: Kazakh respondents, industry questionnaire, GEM 2011	
Institute of Geography of Ministry of Education and Science	1
Centre for Remote Sensing and GIS "Terra"	6
Kazakh Agency of applied ecology ltd.	9
INSTITUTE OF SPACE AND TECHNOLOGY	1
Affiliated State Enterprise "Institute of Seismology"	1
Republican State Enterprise "Kyzylorda Vodkhoz"	1
Ecoservice -C Ltd	1
KAZGEOCOSMOS JSC	3
KazNU by Al-Faraby	1
Conducting soil-landscape studies based on data obtained	1
Institute for Space Research	2
Institute of Geography	8
Total	**35**

Table 2 B: Kyrgyz respondents, industry questionnaire, GEM 2011	
KyrgyzGiproZem	2
Central-Asian Institute of Applied Geosciences (CAIAG)	4
Dep of a Cadastre and registration of the rights to real	5
Ministry of Emergency	1
Jerooyaltyn	1
Karakol-Aksuiskii gosregistr	1
Department of pastures, Ministry of Agriculture	1
Osh engine generating station	1
Osh Enterprise of High Voltage Station	1
Kirgh scientifically technical centre on power at Min. of En	1
State Committee of Water Management and Monitoring	1
Agency of Hydrometeorology at the Min. of emergency situation	1
Kyrgyz Complex Aerogeodesic expedition	1
Department of State Sanitary and Epidemiology Surveillance	1
Seismology institute of National Academy of Science of Kyrgy	1
Project institute Kyrgyzdortransproekt	1
Social fund Eco-GIS	1
GIS-Service LTD	1
Social Fund CAMP Alatoo	1
Kumtor Operating Company	1
Public Corporation "Liniya prava Uran"	1
Bishkek glavarhitektura	1
Institute of Geomechanics and Development of Subsoil, NAS KR	1
Institute of water problems and hydro-power, NAS KR	1
Kyrgyz Scientific Research Institute of irrigation	1
Land and real estate	1
Lesoohotoustroistvo	1
Ltd Ecolesproject	1
Ministry of emergency situations of the KR	1
Rural Development Fund	1
South Kyrgyz Geological Expedition	1
State enterprise Kyrgyzjilkommunsoys	1
Transboundary water program	1
Total	41

Table 2C: Tajikistan respondents, industry questionnaire, GEM 2011	
Design and Research Institute "Fazo"	7
State Establishment of a project on the land registration	6
State Unitary Enterprise "Center of the Earth"	2
State Design Institute "Tajikgiprozem"	3
Environmental Club "Lochin"	1
Land Committee of Geodesy and Cartography of the Republic of	1
Project and research institution "Tojikzaminsoz"	1
State Committee for Land Management, Geodesy and Cartography	1
Total	**22**

In what sector is your firm/organisation working?

It was difficult to categorize the sector where the firm is working in. In Kazakhstan, most firms operate in the environment sector (27 answers), and just 1 in the energy sector. The category "other" contains sectors such as: Space Systems Laboratory (science), seismology, Space-ground geodynamic, Water management and education. In Tajikistan 20 companies work in land administration, 1 in environment and 1 in water management. In Kirghizstan (table 2D), 10 companies work in land administration, 5 in environment as well as 5 in the energy sector. The category "other" is quite broad for the Kyrgyz respondents, as can be seen in the table (table 2D) below.

Table 2D Sector of the firm / organization Kyrgyzstan, industry questionnaire, GEM 2011	
Energy	5
Agriculture	1
Environment	5
Land administration	10
Others:	
Mining	2
geology	4
seismology	1
water management and hydrometeorology	2
Emergencies	3
Public Health	1
urban planning	1
Projecting roads and survey (engineer-ge	1
Forestry	1
Demand support of mountainous villages	1
Geohazards,Water resources, climate, and admin	2
Unknown	1
Total	**41**

Most firms have up to 50 employees, as can be seen in the table below (table 2E). In Kyrghizstan several organization have large numbers of employees, such as the Cadastre (1500 employees), the State enterprise Kyrgyzjilkommunsoys (3000 employees) and the Ministry of Emergency Situations (5000 employees).

Table 2E Number of employees, industry questionnaire, GEM 2011			
Number of employees	<0, 50]	<50, 100]	<100, …>
Kazakhstan	24	7	4
Kirghizstan	22	8	11
Tajikistan	8	9	5
Total	**54**	**24**	**20**

What is the ownership status of your firm/organisation? Most firms in the questionnaire are either state enterprises, or private enterprises, as can be seen in the table below (see table 2F).

Table 2F, Ownership status, industry questionnaire, GEM 2011				
Ownership status	Kazakhstan	Kirghizstan	Tajikistan	Total
Privatised state enterprise	2	1	0	3
State enterprise	11	26	21	58
Private enterprise	19	4	0	23
NGO	0	2	1	3
International organisation	1	7	0	8
Other	2	1	0	3
Total	**35**	**41**	**22**	**98**

Where does your firm/organisation operate?

Companies indicated that they work at different administrative levels, although 80% (especially in Kyrgyzstan and Tajikistan) indicated to work at the national level (of all 152 answers: more than one answer could be filled in). The rest is spread out evenly between Oblast (regional) level, the local and international level (see table 2G).

Table 2G Level of operation, industry questionnaire, GEM 2011					
Firm level	Kazakhstan	Kyrgyzstan	Tajikistan	total	percentage
International level	5	14	6	25	26
National level	32	25	21	78	80
Oblast level (regional)	6	12	10	28	29
Local level	5	15	1	21	21

Use of GIS

Do you currently use GIS (Geographical Information Systems) in your firm/organisation?

Almost all firms (86%) use GIS (see table 2H).

Table 2H Use of GIS by firms, industry questionnaire, GEM 2011					
FirmUses GIS	Kazakhstan	Kyrgyzstan	Tajikistan	total	%
Yes	34	33	17	84	86
No	1	8	5	14	14

You indicated that you use GIS software in your organisation. For what purpose do use GIS software?

Many different purposes of GIS were mentioned. We distinguish several broad categories, such as Earth Sciences, Hydrology, Forestry, environment, Hazards, Health, Community, Automation and others. See table 2G below (data Tajikistan not included):

Table 2G Aims GUIS use within firms / organization, industry questionnaire, GEM 2011	
sector	GIS use
Earth Sciences	With the help of GIS software we create 3d model for geology, and also we use it for transformation from one coordinate system to another.
	Information systems development for geoscience and communication systems
	meliorative condition of irrigated lands bondability, GIS redundant system for each river basin in hydrological data
	The main specialization of "Earth from Space" - fundamental and applied research in the field of study and monitoring of objects on the Earth's surface and of the processes using remote sensing data from space.
	Develop methods and technology assessment and analysis of the stress-strain state of the earth's crust using satellite technology
	Development of high-quality, analytical and numerical methods for studying non stationary dynamic problems of artificial and natural celestial bodies
	Creating a system of space-ground geodynamic and geophysical monitoring of the crust of the Republic of Kazakhstan
Hydro	Mapping, modeling of hydro power, analysis
	Creating GIS maps for river basins
	Estimation of snow stocks for forecasting of a drain of the rivers
Forestry	for creating forest maps(,aps of leshoz and national parks)
Environment(9)	Environment mapping, modeling. RS Data interpretation. Applied Cartography
	Review of work in the field of ecology using remote sensing and GIS in Central Asia and Kazakhstan
Hazards	monitoring of natural hazards, KR
	Scientific research in natural hazards, investigation of landslide susceptibility, hazard and risk
	The study of the seismic regime, and seismic hazard assessment; General, detailed and mikroseysmorayonirovanie territories; Monitoring and prediction of earthquakes; Assessment of seismic risk and prognosis of earthquake damage; Geodynamic monitoring and prediction of dangerous anthropogenic processes; Creation of databases in the field of seismology.
	Developing maps of risks and vulnerability; data analysis, assessment of climate change, seismic risk assessment, planning maps of towns with changing existing cadastre.
	for creating vulnerability maps, for data analysis, climate change assessment, seismic risk evaluation, for planning urban maps with updating existing cadastre
Cadastre	To create land management project and land cadastre
	GIS software are used for the cadastral purposes
	Cadastral database
	GIS software are used for the cadastral purposes and cadastral database

	GIS software are used for the cadastral purposes and cadastral database
	To define location of geodesic points in the plan and altitude (gps measurement)
	CREDO TOPOPLAN for topo surveying of different materials in digital view
	execution of comprehensive tasks in land administration (land inventory, border installation)
Health	Mapping of hotspots of Malaria and other diseases, database development
Community	The GIS is primarily used to complement the community mapping of the pasture and land resources in order to facilitate access of the local land and pasture users to the GIS-aided tools and methods to inform the community decisions regarding the land / pasture use and allocation.
Automation	For 100% transition from analogue to digital variant and to update immediately all changes in plans and maps, and also to create a database of all republic.
Others (non specified)	Operative managements
	Digitizing different thematic paper maps
	creation of thematic maps, analyzing spatial data, structuring and management of spatial data
	To add, store, verify, and analyze of spatial data
	For data processing
	Cartography, Database, Spatial Analysis
	Creating digital layers, creating thematic maps, spatial analysis, spatial data base management system
	All types of tasks that could be completed with the help of GIS
	Digitizing and working with maps data processing Database analyze
	Mapping (7)
	Thematic mapping (geomorphology, ecology, socio-economic, etc.), data analysis, atlas
	For development of projects tasks
	(3) research (science)
	(3) Creation of digital maps The building of geographic data base Cartographical modeling Space images and digital maps processing
	(2) CRS and GIS "Terra" widely uses GIS technologies and provides wide range of services in this field: development of GIS starting from personal to corporate level, turnkey solutions, custom tailored service; development of modules and applications on the basis of the software ArcGIS and MapInfo; digital mapping, systematization of geo-databases; geo-processing and interpretation of spatial data; technical support of developed GIS, application and modules.
	Digital mapping, database creation, mapping type of emergency etc.

What GIS software do you use?

The principle software package used in ArcGIS (mentioned 65 times), and to a much lesser extend ERDAS (6 times), Mapinfo (5 times), AutoCAD (3 times) and Credo (2 times). Other packages very only mentioned by one single respondent. Most companies have a small number of employees using GIS, from 1 to 9 persons (33 answers, mostly in Kyrgyzstan), 22 companies have between 10 up to 19 employees , and few companies, mostly Kazakh companies, have more than 20 employees. The Institute of Geography has the largest number of GIS users (over 50 people).

Of the 98 respondents, 51 indicated that their company uses other GIS software, such as ENVI (14 times), Mapinfo (10 times) and ArcGIS and Erdas(10 times each). Up to 9 employees work with this software, mostly in Kirghizstan; 19 times people answered that from 10 up to 20 employees work with

this 2nd GIs software package, and only 3 answered that more than 20 people work with this software (the latter two predominantly in Kazakhstan).

Open source software is hardly used.

Internships

The next questions focus on the possible role of GEM graduates and students in your firm/organization.

Overall the respondents have a positive attitude towards the GEM programme (table 2H). They think that GEM graduates would be interesting to their firm and industry, especially in Kazakhstan. As well, in Kazakhstan a large percentage of the respondents has no opinion regarding possible internships within their organization.

Table 2H Opinion towards usefulness GEM graduates for firm / organization, industry questionnaire GEM 2011					
GEM role Kazakhstan in %	strongly agree	Agree	somewhat disagree	Disagree	no opinion
Graduates from GEM are valuably potential employees for our firm	40	37	6	3	14
Graduates from GEM are valuable potential employees in our industry	46	34	6	0	14
I see opportunities within my firm/organisation to hire GEM graduates	14	26	11	6	43
My firm/organisation will offer (paid) internships for GEM students	20	17	11	6	46
GEM role Kyrgyzstan in %					
Graduates from GEM are valuably potential employees for our firm	24	56	5	0	15
Graduates from GEM are valuable potential employees in our industry	39	44	5	0	12
I see opportunities within my firm/organisation to hire GEM graduates	20	34	22	10	15
My firm/organisation will offer (paid) internships for GEM students	12	29	20	17	22
GEM role Tajikistan in %					
Graduates from GEM are valuably potential employees for our firm	8	5	1	2	6
Graduates from GEM are valuable potential employees in our industry	9	4	1	1	7
I see opportunities within my firm/organisation to hire GEM graduates	0	1	7	7	7
My firm/organisation will offer (paid) internships for GEM students	0	1	2	4	15

Placements for internships were mentioned by 30 respondents (13 Kazakh, 16 Kyrgyz and 1 Tajikistan). The Kyrgyz cadastre has up to 50 internships available. Others mention from 5 to 10 placements (Kyrgyztransproekt, and in Kazakhstan the Centre for Remote Sensing and Geographic Information Systems, Institute of Space and Technology, Affiliated State Enterprise "Institute of Seismology", the Centre for Remote Sensing & GIS "Terra" amongst others). Smaller number of placements in Kazakhstan are offered by the Institute of Geography, KazNU by Al- Faraby and the Republican State Enterprise

"Kyzylorda Vodkhoz". In Kyrgyzstan the following agencies would offer placements: Jerooyaltyn, Department of pastures (of the Ministry of Agriculture), Osh engine generating station (same as: Osh Enterprise of High Voltage Station), KyrgyzGiproZem, the Ministry of Emergency, Department of State Sanitary and Epidemiology Surveillance, Central-Asian Institute of Applied Geosciences (CAIAG), the Social fund Eco-GIS, Kumtor Operating Company.

The average length of these internships is predominantly 1 to 2 months (mentioned 21 times). Of the respondents, 6 indicated internships of 3 month, and longer internships of 6 or 15 months were only mentioned once.

For Gem graduates, the following organizations and departments are interesting possible future employers (table 2i and 2J). For each department, the specific skills needed are indicated. No data available for Tajikistan.

Table 2i Employment possibility GEM graduates and skills, Kyrgyzstan, industry questionnaire, GEM 2011			
Kyrgyzstan /Name	Department for GEM graduates	Empl	Skills needed for department
Social fund Eco-GIS		-	-
Project institute Kyrgyzdortransproekt	Topographic sector	14	engineer-geodesic skills (measuring horizontal, vertical angles experience in work with single-frequency GPS TC-303,TCR1205,TC-1102 and double-frequency GPS RTK)
	complex-road department	60	Projecting roads 2-3-4-5 category To be an experienced user of PC(Credo 3, Credo 1, Credo-DAT-4) To have knowledge about geodesy theory
Jerooyaltyn	Survey	3	Working with total stations
			basics of geodesy
			ability to use specialized software as Gemcom, Surpac
Department of State Sanitary and Epidemiology Surveillance	Epidemiological department	10	GIS skills, modeling of situations
	Project "Control of Malaria in Kyrgyzstan"	9	GIS skills, modeling of situations
CAIAG	Geodynamics and geohazards	9	the candidate should be close more scientific researches
	The technical infrastructure	12	Engineering skills will be enough
	water and water resources	8	the candidate should be close more scientific researches
KyrgyzGiproZem	Land Administration	9	IT - specialists
			specialists in geodesy
			specialist in land administration
	GIS	13	professional user of PC and software
Ministry of Emergency	Gis department	5	competence in ArcGIS, MapInfo
Kumtor Operating Company	Mining Engineering	4	Mining, geology, mapping
Central-Asian Institute of Applied Geosciences (CAIAG)	Geo-dynamics and Geohazards	9	Fundamental knowledge in geosciences(geo-ecology, seismology, engineering geology and GIS)

	Climate, Water and Geo-ecology	11	Research in the field of water resources and climate change, ecology, glaciology
	Technical infrastructure and data Management	12	creating and maintenance of monitoring networks, development of computing network of the Institute, building and maintenance of geodatabase, remote sensing and global navigation satellite system (GNSS)
Dep of Cadastre and registration of the rights to real estate	Cartography and land management	4	Bases of cartography and topography should be known
	IT	10	The software is hardware
	Land management and topography	5	land cadastre
Department of pastures, Ministry of Agriculture	Pasture Department	4	GIS
Osh Enterprise of High Voltage Station	Information Technology	4	IT-specialists
Osh engine generating station	Information Technology	6	IT-specialists
			specialists with a technical education in the field of electric and heat energy

Table 2J Employment possibility GEM graduates and skills, Kazakhstan, industry questionnaire, GEM 2011			
Name	Department for GEM graduates	Empl	Skills needed for department
Republican State Enterprise "Kyzylorda Vodkhoz"	water use	7	skills of water use planning
	designing	15	cartography and topography of projected places
KazNU by Al-Faraby	Geomorphology and mapping	25	Geography, cartography and Geoinformatica
Institute for Space Research	research institute of remote sensing	30	Data transmission and reception;
	Institute of ionosphere	45	Base of satellite data and their integration into the international network
	Geography research institute	70	construction of various thematic maps, etc.
Affiliated State Enterprise "Institute of Seismology"	GIS modeling of seismic hazard.	11	GIS software for mapping of results
	Geo-space communications and information	20	For continuous registration of earthquakes of varying intensity and distance of applicability is a complex of modern equipment that includes digital seismic-metal station IDS-24, GSR-18, Q-730, seismic system of the Vulcan. From The aim of the registration of modern crustal movements are carried out work on Outer Space Geodesy at the point of GPS.
	Integrated earthquake prediction.	21	For continuous registration of earthquakes of varying intensity and distance of applicability is a complex of modern equipment that includes digital seismic-metal station IDS-24, GSR-18, Q-730, seismic system of the Vulcan. From The aim of the registration of modern crustal movements are carried out work on Outer Space Geodesy at the point of GPS.
Institute of Space and	GIS centre Terra	50	The development of desktop GIS Platform ArcGIS Engine

Technology			9.2 and MapObjects
	Laboratory of Technical Regulation in the field of	12	Development and implementation of GIS applications and modules for specialized tasks (ArcGIS, MapInfo)
Institute for Space Studies	Research institute of spatial analysis	20	Basic and applied research aimed at developing technologies to address urgent problems of space monitoring of emergency situations, agricultural land, mineral resources and environmental protection.
Centre for Remote Sensing and Geographic Information Systems	Space Systems Laboratory scientific purposes	15	Conducting soil-landscape studies based on data obtained
	GIS and DBMS department	12	Know GIS
	Department Geodesy and Cartography	12	Know geodesy and cartography
	Department Remote Sensing	5	Know the remote sensing
			Thematic mapping
			the creation of narrow-purpose, thematic maps based on ground-based measurements and remote sensing data
Institute of Geography	Laboratory of Geomorphology	22	Work in programs Arcgis and Envi

GEM curriculum needs

The respondents were asked to assess the importance of various skills GEM students should acquire during their studies. In order of importance, the respondents ordered the importance of skills as follows:

1. GIS knowledge
2. GIS software skills
3. Database knowledge
4. English
5. Skills in remote sensing software
6. Knowledge of spatial databases
7. Skills in programming
8. Interdisciplinary skills
9. Management skills
10. International experience

The scores are indicated in the table below (table 2K).

Table 2K, Importance of GEM student skills, industry questionnaire, GEM 2011					
Skills / in %	very important	important	not very important	not important	no opinion
GIS knowledge	73	22	1	1	2
GIS software skills	61	32	4	0	3
Database knowledge	43	47	6	1	3
Skills in remote sensing software	37	42	15	1	5
English	39	37	14	3	7
Knowledge of spatial databases	30	50	15	1	4
Skills in programming	26	43	24	3	4
Interdisciplinary skills	30	33	28	6	4

Management skills	17	52	27	2	2
International experience	16	46	28	3	7

Comparing these results between Kyrgyzstan,Kazakhstan and Tajilistan, we can clearly see that the importance of English (6th place in Kyrgyzstan, 4th place in Tajikistan, resp. 3rd place in Kazakhstan) and management skills (10th place in Kyrgyzstan, 6th in Tajikistan, resp. 5th place in Kazakhstan) is assessed differently in these countries. English and management skills are more appreciated in Kazakhstan.

The respondents were asked assess the importance of several suggested GEM modules for their organization or firm. In order of importance, the respondents ordered the importance of these modules as follows:

1 Geodatabase,
2 Data models
3 SDI Applied cartography
4 Data acquisition and data integration
5 Remote sensing
6 Spatial analysis
7 Project management
8 Geospatial management of resources
9 Geospatial environmental management

However, it must be noted that the majority of the respondents indicated that all modules are either very important or important.

Conclusion

In total 98 questionnaires from industry were filled in: 35 in Kazakhstan, 41 in Kyrgyzstan and 22 in Tajikistan. Almost half of the questionnaires were filled in directly by the respondents via the internet (in English), and almost these entire internet filled in questionnaires were done by industry respondents in Kazakhstan.

The sector where the firms/ organizations of the respondents are working in is rather broad. It is difficult to categorize clearly the sector where the firm is working in. Most respondents work in firms which have up to 50 employees. Most firms in the questionnaire are either state enterprises, or private enterprises, and 50% of the firms (especially in Kyrgyzstan and Tajikistan) indicated to work at the national level. Most firms in the questionnaire are either state enterprises, or private enterprises.

Almost all firms (86%) use GIS. Many different uses of GIS within the firms or organizations have been mentioned, such as uses within Earth Sciences, Hydrology, Forestry, environment, Hazards, Health, Community, Automation and others. Open source software is hardly used. Most companies use commercial software, mainly ArcGIS, and to a much lesser extend ERDAS, Mapinfo, AutoCAD and Credo.

Overall the respondents have a positive attitude towards the GEM programme. They think that GEM graduates would be interesting to their firm and industry, which is especially the case in Kazakhstan. Possible placements opportunities for internships were mentioned by 30 respondents in Kazakhstan, as well as Kyrgyzstan. Just one placement was mentioned for Tajikistan. The Kyrgyz cadastre has up to 50 internships available. Others mention from 5 to 10 placements each. The average length of these internships is predominantly 1 to 2 months. This report contains two tables (table 10 and 11) which provide an overview of the exact organizations and departments that are interesting as possible future employers for GEM graduates.

The opinion of industry regarding the content of the GEM curriculum is positive. Soft skills such as English and management skills are less appreciated in Kyrgyzstan. Regarding the module content of the GEM curriculum, the majority of the respondents indicated that all modules are either very important or important. So regarding the disciplinary Geo informatics content of the GEM, the respondents have not made a clear ordering of the relative importance of all the elements.

3. Potential teachers

Introduction

Aim of this questionnaire is to learn from the respondents' experiences as lecturers involved in geography and / or GIS teaching and training, with the ultimate aim of eventually assessing the potential of possible future teachers in the curriculum of the new international educational master programme in Geoinformatics (GEM). Questions were asked such as: what should be the student qualifications (disciplinary background, English and computer skills) and the end terms of the Gem programme; what topics do the potential teachers teach and what topics do they find crucial to include in the GEM programme? Spatial Sciences here is to be understood in a wider sense, including all digital geospatial concepts, methods and technologies, including cartography, digital mapping etc. Potential GEM teachers lecturing in the field of Spatial Sciences were asked to fill in the questionnaire.

This report consists of three parts: 1) general information of the potential teachers, such as experience in teaching, and computer and English language skills; 2) a section on the GIS training needs and interests; and 3) a final section on the GI-teaching experience of the teachers. The conclusion summarizes the findings. In the Annexes a detailed overview is given of all the courses the potential teachers are involved in, with the exception of Tajikistan.

The questionnaire was held from February – May 2011 in Kyrgyzstan (31 respondents), Kazakhstan (32 respondents), Tajikistan (10 respondents) with a total of 73 respondents. Of the respondents, 37% were filled in directly by the respondents via the internet, and 63% were filled in on paper copies of the questionnaire, and filled in via the internet by the GEM project members.

General information potential teachers

The Kazakh respondents work in three universities (see table 3A): Almaty technology university (economic and business, tourism), KazNU (Geographical faculty, covering a wide range of different courses, from beta to gamma), Korkyt Ata Kyzylorda State University (Natural Sciences, Polytechnic). The Kyrgyz respondents work at three different universities as well: KSUCTA (various, such as construction, engineering, ecology and energy, trades), Osh TU (various such as IT, Energy, Nature) and UCA (IT). As expected, the situation in Central Asia does not differ significantly from GI education in other parts of the world: the field of GI-related studies programmes varies enormously, from pure technical to more social fields. The Tajik respondents work at 4 different universities.

Table 3A, Overview background respondents, potential GEM teachers questionnaire, 2011				
Country	University	Faculty	Study program	Number
Kazakhstan	Almaty technology university	Economics and business	Tourism and service	1
	KazNU	Geography faculty	Department of Physical Geography	1
			Economic, social and political geography	6
			geomorphology and cartography	6

			GIS	1
			Hydrology of land	1
			Meteorology	1
			Recreational geography	1
	Korkyt Ata Kyzylorda State University	Natural Sciences	Biology, Geography and Ecology	4
		Politechnical	Geography	1
			Land Management	8
			Life Safety and Management of Natural resource	1
Kyrgyzstan	KSUCTA	Construction Technology	Geodesy and geoinformatics	3
		Institute Civil Engineering, Economics and Management	Geodesy and geoinformatics	14
		Institute of Ecology and Energy saving	Heat and Gas Supply and Ventilation	2
		Institute of Innovative trades	Valuation and Management	1
	Osh TU	Cybernetics and Information Technology	Network and Telecommunication Systems	1
			Software Engineering	2
		Electrical Energy Faculty	Electricity Transmission	1
		Software Technology	IT Technology	1
		Technology & Nature Maintenance	Environmental Protection & Ecology	2
			Mining Geology	2
	UCA	IT	IT	2
Tajikistan	Tajik agrarian Universty		Land Management	1
		Hydromelioration	Geodesy and geoinformation	1
	Tajik State pedagogical university	Geography	Tourism	4
			Economy geographer	1
		IT	IT	1
	UCA	Geoinformatics	Geoinformatics Master	1
	Tajik technical University	Mechanical & Technology	Life safety and Ecology	1

In the table below (table 3B) the number of years the respondent has been teaching at the university is indicated. Almost 50% of the respondents has more than 5 years experience in teaching. Only 22% of the respondents work mainly in research. Most respondents (especially amongst the Kyrgyz respondents) have an "other" degree (47%) , 16% hold a PhD, 29% a master degree, and only 8% a BSc degree. Almost all teachers have an official teacher qualification. The majority of the respondents (60%) has no experience in international research or international teaching, slightly less in Kyrgyzstan.

Table 3B: Number of years teaching at university, potential GEM teachers questionnaire, 2011					
Years of experience	Kazakhstan	Kyrgyzstan	tajikistan	total	percentage
less than 1 year	4	5	4	13	18
1 - 2 year	2	4	1	7	10
2 - 5 year	8	8	1	17	23
more than 5 year	18	14	4	36	49
Total	**32**	**31**	**10**	**73**	**100**

The level of English amongst the potential teachers is basic (see table 3C): 56% can have a conversation in English, 33% has studies subjects in English, and only 11% has experience in teaching in English. Of the respondents, 54% uses English teaching materials during their lectures; and 62% has not followed during their studies or work a course in scientific writing in English. English software is used by 77% of the respondents. Also the potential teachers indicated their use of English teaching materials in their courses (slightly more so in Kazahkstan): 68% uses English literature, 77% software in the English language, and 79% uses English websites.

Table 3C: Teaching language skills, potential GEM teachers questionnaire, 2011					
Teaching language skill	kazakhstan	kyrgyzstan	tajikistan	total	percentage
experience in teaching English	2	6	0	8	11
have studied subjects in English	7	14	3	24	33
can have a conversation in English	23	11	7	41	56
Average	**2.66**	**2.16**	**2.7**	**2.45**	

Of the potential teachers of the GEM programme, 92% has a computer at home, and 73% has internet access at home. The computer literacy varies between Kazakhstan and Kyrgyzstan with Tajikistan in the middle, the level being slightly lower among the Kyrgyz respondents (see table 3 D). Overall, 12% has an advanced level of computer skills, 42% uses application software in GIS, and 45% uses standard Office software.

Table 3D: Teacher computer skills, potential GEM teachers questionnaire, 2011					
Computer literacy	kazakhstan	kyrgyzstan	tajikistan	total	percentage
can program	1	6	2	9	12
uses application software in GIS	16	13	2	31	42
uses standard office software or less	15	12	6	33	45
Average	**1.72**	**1.48**	**1.6**	**1.62**	

GIS training needs and interests

Table 3E indicates the GI-software packages used by the respondents (data Tajikistan not included).

Table 3E: GI- related software used by respondents, potential GEM teachers questionnaire, 2011			
GI-Software	Mentioned first	Mentioned second	Mentioned third
ArcGIS	30	7	
AutoCAD	9	3	3
Mapinfo	5	1	4
Credo	2	10	
DevInfo	1		
ENVI		2	
ERDAS		7	1
Idrisi	1		
QGIS		5	
PostGIS		1	1
SAGA		1	
Other (Global Mapper, Surfer, eCognition 8, PostgreSQL and MapServer)			4

GI-software mostly used by the respondents in order of importance are: ArcGIS, AutoCAD, CREDO, Mapinfo, ERDAS. Many respondents indicated that this is Open Source software, where in fact it is commercial software.

The potential teachers also indicated their interest in specific topics they would like to teach in the GEM curriculum. In the table below (table 3D), these topics are listed in order of popularity, Geospatial Environmental Management being most popular, and Remote Sensing less popular. Between the two countries there some slight differences, the popularity of the Introductory GIS course and the Geo course being higher in Kyrgyzstan in comparison to Kazakhstan. The majority would like to receive extra training for the GEM program (73%).

Table 3D: Interest to teach GEM course modules, potential GEM teachers questionnaire, 2011				
Topic GEM curriculum	% not interested	% not very interested	% interested	% very interested
Geospatial environmental management	5	3	22	70
Geospatial management of resources	8	7	25	60
Applied cartography	10	4	38	48
Project management	4	11	41	44
Geo databases, SDI	7	4	48	41
Spatial analysis	7	11	34	48
Introduction, orientation	12	12	33	42
Data models	10	10	47	34
Data aquisition and data integration	7	12	51	30
Remote sensing	10	23	30	37

GI-teaching experience in courses

More than half of the potential teachers has no experience in teaching courses related to cartography or GIS during the last three years. 30% has taught one such course, and 18% teaches at least two such courses. The average GI-teaching experience in Kazakhstan (average of 0.78 courses) is slightly higher than in Kyrgyzstan (average of 0.68 courses). Tajikistan has an average of 0.2 courses.

Conclusion

The Kazakh respondents work in different faculties in the Almaty technology university, KazNU and Korkyt Ata Kyzylorda State University, and the Kyrgyz respondents work at different faculties at the KSUCTA , Osh TU, and UCA. The Tajik respondents work at seven faculties in four different universities. The field of GI-related studies programmes varies enormously, from pure technical to more social fields and applications of GIS.

Many respondents (49%) have more than 5 years experience in teaching and have an official teacher qualification. Most respondents have an "other" degree 16% hold a PhD, 29% a master degree, and only 8% a BSc degree. There is very little experience in international research or international teaching.

The level of English amongst the potential teachers is basic: 56% can have a conversation in English, 33% has studied subjects in English, and only 11% has experience in teaching in English. Of the respondents, 54% uses English teaching materials during their lectures; English software is used by 77% of the respondents.

Of the potential teachers of the GEM programme, 92% has a computer at home, and 73% has internet access at home. Overall, 12% has an advanced level in IT, 42% uses application software in GIS, and 45% uses standard Office software. Main software packages used are ArcGIS, Autocad, CREDO, MApinfo, ERDAS. Many respondents indicated that this is Open Source software, were in fact it is commercial software. The potential teachers also indicated their interest in specific topics they would like to teach in the GEM curriculum. Geospatial Environmental Management being most popular, and Remote Sensing less popular.

More than half of the potential teachers have no experience in teaching courses related to cartography or GIS during the last three years; 30% has taught one such course, and 18% teaches at least two such courses.

4. Conclusions

Each of the previous chapters includes a summary and conclusions related to the questionnaire from the current course offerings, the industry demands as well as the potential teachers. In general, there are six overall conclusions, which we want to stress in this final chapter.

1. GIS is currently widely used in the three Central Asian countries. Not only do many firms and organizations use GIS, and GIS forms part of many academic courses, but also we can see that GIS is used in a wide variety of application areas and disciplines.
2. There are many educational programmes in the three countries which provide sufficient knowledge for future students to enter the GEM master programme. Potentially, there are plenty bachelor programmes from which students can be recruited for the GEM master.
3. As GIS is used in many courses and by many organizations and firms, we expect to be able to recruit sufficient numbers of qualified staff to take part in the GEM programme.
4. In general we foresee potential problems in three fields: a) the level of English of students as well as potential staff is rather limited, b) the computer skills of students is at a basic level and c) the computer facilities and internet connections require extra attention, which is already included in the GEM project proposal.
5. The respondents are very positive about the proposed GEM curriculum and have added some elements to this curriculum as well.
6. Industry shows a keen interest in the GEM programme, and is willing to offer internships. A large majority considers GEM graduates as valuable employees for their firm or organization in the near future.

Annex A Spatial Course Descriptions: current courses Central Asia

Kazakhstan	
Bachelor in architecture and building	
Course: architecture and building	
Objective:	Using the AutoCAD Architecture 2010 software, the participant will learn the basics of using the software, such as the interface, placing walls, doors, windows, floors, roofs, creating sections and elevations, and annotating the model with text, dimensions, and tags.
Learning outcomes:	1. Students will demonstrate an ability to communicate effectively using technical, graphical, oral and written formats. 2. Students will demonstrate appropriate mastery of industry drawing standards and Computer‐Aided Design techniques in the design of components, systems or processes of architectural, civil or mechanical design. 3. Students will demonstrate an ability to conduct, analyze and interpret experiments using emerging applications of mathematics, science, engineering and technology to improve processes. 4. Students will demonstrate an ability to function effectively on teams to identify, analyze and solve technical problems of contemporary professional, societal and global issues while respecting diversity. 5. Students will demonstrate an ability to understand professional, ethical and social responsibilities and show a commitment to quality, timeliness, and continuous improvement in lifelong learning. 6. Students will demonstrate basic competence in the use of at least two CAD software applications. 7. Students will demonstrate basic graphical literacy. 8. Students will explain basic standard practices in architectural, mechanical and civil drafting. 9. Students will access information from public libraries, research libraries, online sources, appropriate codes and standards, professional organizations, and vendor catalogs. 10. Students will use graphic principles in the solution of problems relating to drafting and/or design. 11. Students will produce drawings in accordance with industry standards e.g., ANSI / ASME, ISO, AIA, Uniform Building Codes.
Keywords	AutoCAD Architecture 2010 software emerging applications two CAD software applications
Entry requirements	-
Number of students	60
Hours total	135
	Hours practical classes: 55
	Hours lectures: 40
	Hours self study: 40
Language teaching	Kazakh
Language books, articles, syllabi	English / Russian
Software	Autocad / CREDO

Kazakhstan	
Bachelor in Geodesy	
Course: digital cartography	2x
Objective:	mapping by GIS software
Learning outcomes:	mapping by GIS software
Keywords	Map, raster, vector, visualisation
Entry requirements	surface mapping methods

Number of students	40 OR 150
Hours total	60
	Hours practical classes: 30
	Hours lectures: 15
	Hours self study: 15
Language teaching	Russian
Language books, articles, syllabi	Russian OR Russian (some English articles)
Software	Standard office, GIS

Kazakhstan	
Bachelor in computing and software	
computing and software	
Objective:	-Define Reusable Learning Objects (RLO); -Describe the characteristics of learning objects; -Discuss the use of learning objects and their cataloguing; -Describe packaging and publishing learning objects (including SCORM) ; -Describe the advantages an…
Learning outcomes:	-Describe what programming languages are; -Give examples of modern computer languages; -Describe basic processes of programs e.g. input, output; -Outline the program development cycle; -Describe 'generations' of languages; -Distinguish between interp
Keywords	Reusable Learning Objects
publishing learning objects
programming languages
modern computer languages
Entry requirements	-geography; -geographical information systems; -cartography; -computer science/software engineering; -surveying; -town planning.
Number of students	60
Hours total	135
	Hours practical classes: 55
	Hours lectures: 40
	Hours self study: 40
Language teaching	Russian
Language books, articles, syllabi	other
Software	Autocad / CREDO

Kazakhstan	
Bachelor in Geodesy and Geoinformatics	
geoinformatics	
Objective:	The main provisions and objectives of GIS mapping Obtaining and providing data to the systems of Geodesy and Cartography
Learning outcomes:	Methods of computer processing of images to create thematic maps
Keywords	Maps, vector DEM
Entry requirements	-
Number of students	200
Hours total	60
	Hours practical classes: 30
	Hours lectures: 15
	Hours self study: 15
Language teaching	Russian
Language books, articles, syllabi	English / Russian
Software	Office and GIS software

Kazakhstan	
Bachelor in Geography	
GIS in Physical Geography	
Objective:	Landscape structure mapping, modeling
Learning outcomes:	Landscape structure mapping, modeling methods
Keywords	Landscape, mapping, modeling
Entry requirements	computer skills, cartography
Number of students	100
Hours total	60
	Hours practical classes: 30
	Hours lectures: 15
	Hours self study: 15
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, GIS

Kazakhstan	
Bachelor in Geography	
Automatic cartography methods	
Objective:	to learn methods of automatic cartography
Learning outcomes:	automatic mapping skills
Keywords	Raster, vector, geo database, digitizing, visualisation
Entry requirements	computer skills
Number of students	30
Hours total	60
	Hours practical classes: 30
	Hours lectures: 15
	Hours self study: 15
Language teaching	Kazakh
Language books, articles, syllabi	Russian
Software	Office, GIS

Kazakhstan	
Bachelor in Geography	
Course: GIS in geomorphology	
Objective:	Using GIS-technologies in Geomorphology
Learning outcomes:	GIS-methods in Geomorphology skills
Keywords	Geomorphology, GIS, analysis, relief, spatial data
Entry requirements	computer skills, Basic Geomorphology
Number of students	20
Hours total	60
	Hours practical classes: 30
	Hours lectures: 15
	Hours self study: 15
Language teaching	Kazakh
Language books, articles, syllabi	Russian
Software	Office, GIS

Kazakhstan	
Bachelor in informational technologies	
Course: informational technologies	

Objective:	Apply fundamental systems analysis and design concepts and problem-solving strategies to information technology problems; Analyze, design, and implement solutions to business problems; Create and test computer information systems solutions for business
Learning outcomes:	-Use clear and concise map symbology; -Georeference data to real locations; -Create, edit, and organize GIS data; -Perform GIS data analysis using geoprocessing and modeling tools; -Apply the three principle purposes of visualization (interpretation,
Keywords	abstract geographic information Spatial data GIS solutions Georeference data
Entry requirements	-geography; -geographical information systems; -cartography; -computer science/software engineering; -surveying; -town planning.
Number of students	60
Hours total	135
	Hours practical classes:55
	Hours lectures: 40
	Hours self study: 40
Language teaching	Kazakh
Language books, articles, syllabi	Kazakh
Software	AutoCAD/ CREDO

Kazakhstan	
Bachelor in water resources	
Course: water resources	
Objective:	Understand Arc Hydro surface water and groundwater data model Extending Arc Hydro data model Core Arc Hydro tools functionality Advanced Arc Hydro tools functionality Combine Arc Hydro data structure and tools for solution of real water resource problems Extending Arc Hydro tools (development of custom functionality) Integration of external models into Arc Hydro
Learning outcomes:	Demonstrate the basic concepts and operation of GIS for water resources Data models, data sources, map projections, Arc Hydro modeling concepts • Demonstrate ability to create digital data models of water resources in GIS: From existing data sources, such as NHD, River Reaches, time series, etc. From DEMS to create watersheds, streams and drainage points Apply ArcHyrdo data model Build a geometric network for streams and rivers • Demonstrate ability to conduct spatial analyses of water resources Conduct hydrologic calculations using map algebra on raster grids Analyze a digital elevation model of land surface terrain to derive watersheds and stream networks
Keywords	digital data model management, Arc Hydro tools, map projections, digital data model
Entry requirements	
Number of students	50 to 60
Hours total	135 or 90
	Hours practical classes: 55 or 40
	Hours lectures: 40 or 25
	Hours self study: 40 or 25
Language teaching	Kazakh
Language books, articles, syllabi	English / Russian
Software	AutoCAD / CREDO

Kyrgyzstan	
Bachelor in Ecology	
Course: Ecological mapping	
Objective:	Basic knowledge on main methods of ecological mapping and landscape design
Learning outcomes:	- to know basics of mapping, - to be able to design maps
Keywords	Scale, relief, surveying, profile, leveling

Entry requirements	Basics of Informatics, Engineering graphics, Landscape study, Landscape geophysics, Geochemistry, Biogeography
Number of students	40
Hours total	80
	Hours practical classes: 16
	Hours lectures: 24
	Hours self study: 40
Language teaching	Kyrgyz
Language books, articles, syllabi	book
Software	Office

Kyrgyzstan	
Bachelor in Ecology	
Course: GIS in Ecology	(2 x in database, GIS?)
Objective:	to gain general knowledge on GIS concept
Learning outcomes:	To be able to use GIS for solving ecological problems (using ArcVIEW)
Keywords	ESRI, raster model, vector model, DBMS, GIS history
Entry requirements	computer skills
Number of students	150
Hours total	80
	Hours practical classes: 32
	Hours lectures: 32
	Hours self study: 16
Language teaching	Russian and Kyrgyz
Language books, articles, syllabi	Russian
Software	Office and ArcView 3 (English)

Kyrgyzstan	
Bachelor in Ecology	
Course: Geodesy with Cartography	
Objective:	General information about surveying by using geodetic equipment, design and formatting of maps and cartographic profiles
Learning outcomes:	- to know surveying by using geodetic equipment, - to know basics of map design
Keywords	Scale, relief, surveying, profile, leveling
Entry requirements	?
Number of students	40
Hours total	66
	Hours practical classes:18
	Hours lectures: 18
	Hours self study: 30
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
Bachelor in geodesy	
Course: the higher geodesy, photogrametry	
Objective:	To learn students to carry out air photographies, land and cartographical works
Learning outcomes:	To learn to carry out survey and taking works, to use electronic taheometrs, with GIS application
Keywords	Air photography, topographic,geodetic shooting, Project studies, taheometric survey, GPS

Entry requirements	computer literacy, mathematics, topographical drawing and english language
Number of students	12
Hours total	136
	Hours practical classes:36
	Hours lectures: 36
	Hours self study: 54
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, GIS

Kyrgyzstan	
Bachelor in geodesy	
Course: Applied geodesy	
Objective:	Topographic and geodetic equipments, observation of constructions deformation, preparation of initial data for drawing up of plans
Learning outcomes:	technology and methods of geodetic measurements, perspective of technological development of the enterprise topographic surveying production
Keywords	geodetic measurement, topography
Entry requirements	-
Number of students	10
Hours total	148
	Hours practical classes:34
	Hours lectures: 34
	Hours self study: 80
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, Excel, Gemcom

Kyrgyzstan	
Bachelor in Geology	
Course: topography	
Objective:	No data
Learning outcomes:	No data
Keywords	No data
Entry requirements	No data
Number of students	No data
Hours total	No data
	Hours practical classes:
	Hours lectures:
	Hours self study:
Language teaching	Russian
Language books, articles, syllabi	Russian, English
Software	Office

Kyrgyzstan	
Bachelor in GIS technology	
Course: GIS technology in emergency situation field	
Objective:	To give base knowledge about Gis technology for the students
Learning outcomes:	They will get elementary base of GIS technology.
Keywords	Model, geodatabase, map layout, pgs mapping
Entry requirements	good user of PC
Number of students	8

Hours total	64
	Hours practical classes:32
	Hours lectures: 32
	Hours self study:
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, GIS

Kyrgyzstan	
Bachelor in Geography	
Course: GIS	3 times in database. Information below contains all.
Objective:	knowledge of GIS software, creating of map, geo-information processing
Learning outcomes:	creating of thematic maps, digitizing map, spatial analysis
Keywords	Topography, Database, data Basis geodesy, Remote Sensing, map Cartography, Visualization, Mathematical modeling
Entry requirements	geographical knowledge OR computer skills
Number of students	220 OR 30
Hours total	117 OR 48
	Hours practical classes: 36 OR 12
	Hours lectures: 36 OR 24
	Hours self study: 45 OR 12
Language teaching	Russian
Language books, articles, syllabi	Russian, 1 x English
Software	GIS

Kyrgyzstan	
Bachelor in Geography	
Course: Gis in Ecology	
Objective:	Creation and studying of topographic maps
Learning outcomes:	knowledge personal computer, internet, ArcGis
Keywords	working with the catalog, working with the database, working with spatial data, Scanning and data transmission in ArcGis
Entry requirements	computer and english skills
Number of students	180
Hours total	90
	Hours practical classes: 20
	Hours lectures: 30
	Hours self study: 40
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	GIS

Kyrgyzstan	
Bachelor in Geography	
Course: Economic Geography	
Objective:	study of geography and population distribution, economic geography
Learning outcomes:	geographical location and economic situation of countries and numerical growth
Keywords	the world economy, the economic grow, migration, the geographical location of countries
Entry requirements	Ability to use maps, computer literacy and the economy
Number of students	100
Hours total	90
	Hours practical classes: 28

	Hours lectures: 34
	Hours self study: 28
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
Bachelor in Geography	
Course: Geographical Analysis	
Objective:	Studying of maps
Learning outcomes:	Should be able to use maps, to fill them, to know value of signs on a map
Keywords	Compass, map, earth, conventional signs
Entry requirements	Should be able to use atlases, to put objects and changes on maps
Number of students	10
Hours total	90
	Hours practical classes: 36
	Hours lectures: 28
	Hours self study: 26
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
Bachelor in Geography	
Course: Geography	
Objective:	The basic concepts of geography
Learning outcomes:	To make correctly of thematic maps
Keywords	Map, scale, longitude, latitude
Entry requirements	Computer and mathematical skills
Number of students	100
Hours total	117
	Hours practical classes: 36
	Hours lectures: 36
	Hours self study: 45
Language teaching	English
Language books, articles, syllabi	Russian
Software	Office and GIS

Kyrgyzstan	
Bachelor in Geography	
Course: Innovation Technology in Geography	
Objective:	introduction with software and develop topographic map
Learning outcomes:	After this course student can create topographical maps
Keywords	Technology of topographic maps in PC, Computer competence
Entry requirements	geography, basic concepts of cartography, mathematics, Computer competence
Number of students	10
Hours total	128
	Hours practical classes: 32
	Hours lectures: 32
	Hours self study: 64
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian

Software	Office, GIS, statistical software
Kyrgyzstan	
Bachelor in Tourism	
Course: GIS	
Objective:	ArcView 9.1
Learning outcomes:	Digitizing map, creating 3D map, Analysis
Keywords	ArcCatalog, Layers, GPS, 3D analysis
Entry requirements	Computer skills
Number of students	30
Hours total	48
	Hours practical classes: 12
	Hours lectures: 24
	Hours self study: 12
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	GIS

Kyrgyzstan	
Master Programming engineer	3 times in database exactly same info
Course:	Software Technology
Objective:	The main objectives are to prepare students in the field of computer programming.
Learning outcomes:	The students can work in different fields like statistical calculations and mathematical modules.
Keywords	Programming in C++,Visual basic,Matlab. Graphical softwares. Web-Designing, Web programming and designing, Internet skills Artifical Intellectual Systems Ms. Office Programms Database Networking Technology Mathematical Calculations and statistical modules. Operational systems
Entry requirements	Solid background in physics,mathematics and informatics
Number of students	20
Hours total	240
	Hours practical classes:80
	Hours lectures: 80
	Hours self study: 80
Language teaching	Russian
Language books, articles, syllabi	English / Russian
Software	Office, GIS, statistical software

Kyrgyzstan	
Bachelor in physical geography	
Course: Topography with geodesy bases, GIS	
Objective:	database for creating map, creating map, map use
Learning outcomes:	To make thematic maps with GIS software
Keywords	Database, Modeling methods, spatial analysis, images
Entry requirements	Knowledge of computer software, knowledge of English language
Number of students	50
Hours total	64
	Hours practical classes:18
	Hours lectures: 36

	Hours self study: 10
Language teaching	Russian
Language books, articles, syllabi	English / Russian
Software	Office, GIS

Kyrgyzstan	
Bachelor in Software Engineering	
Course: Special Course GIS and Customization	
Objective:	1. Principles of Remote Sensing and GIS technologies 2. Create a map 3. Geodatabase and customization
Learning outcomes:	1. Understand the principles of Remote Sensing and GIS technologies 2. Represent information in map 3. To develop simple applications
Keywords	remote sensing, geodatabase, customization, mapping
Entry requirements	1. background in physics 2. computer skills 3. computer modeling 4. geography
Number of students	25
Hours total	90
	Hours practical classes:68
	Hours lectures: 17
	Hours self study: 21
Language teaching	English
Language books, articles, syllabi	English
Software	Office, GIS, statistical software

Kyrgyzstan	
Degree specialist in Electrical Energy (master)	
Course: Electro-Energical Stations	
Objective:	to prepare the students as Electrical Engineers.
Learning outcomes:	They can work as Engineers in Energy producing plants, Scientific Researches and Teachers in Universities.
Keywords	Production of Electrical Energy; Transportation of Electrical Energy; Relay Protection and automation of Electrical Energy systems; Electrical Section of stations and grade stations; Special Non traditional and renewable resources of Electrical Energy
Entry requirements	Strong Background in Physics, mathematics, informatics and foreign languages.
Number of students	120
Hours total	500
	Hours practical classes:120
	Hours lectures: 120
	Hours self study: 260
Language teaching	Russian
Language books, articles, syllabi	Russian (bit English)
Software	Office, statistical software

Kyrgyzstan	
Degree specialist in computer programming (master)	
Course: Technician	
Objective:	Computer programming, web design, network administration
Learning outcomes:	Programmer, web master, network administrator
Keywords	C++, Networks technologies, HTML, php, java script, java, xml, Basic computer skills,

	Server technologies
Entry requirements	Physics, mathematics, informatics
Number of students	15
Hours total	240
	Hours practical classes:80
	Hours lectures: 80
	Hours self study: 80
Language teaching	Russian
Language books, articles, syllabi	Russian (bit English)
Software	Office, statistical software

Kyrgyzstan	
Degree specialist in computer programming (master)	
Course: Software technology	
Objective:	The main objectives of the course are to prepare the students in the field of computer programming
Learning outcomes:	They can work in statistical fields and in computer programmings
Keywords	Programming in C++,Visual basic, Graphical software, database, Web programming and designing, Networking
Entry requirements	Background in physics and mathematics
Number of students	15
Hours total	240
	Hours practical classes:80
	Hours lectures: 80
	Hours self study: 80
Language teaching	Russian
Language books, articles, syllabi	Russian (bit English)
Software	Office, GIS, statistical software

Kyrgyzstan	
Degree specialist in Environmental Protection (other)	
Course: Basic concepts of GIS in Ecology	
Objective:	Eco-information system as a tool for integrated environmental monitoring. Basic concepts of remote sensing. The structure and basic concepts of GIS. Digital maps
Learning outcomes:	Skills to prepare an integrated information environment. Collection of data for forecasting the position of the environment
Keywords	Vector and raster data, environmental monitoring, geodatabase, remote sensing
Entry requirements	computer competence, geodesy, cartography
Number of students	15
Hours total	216
	Hours practical classes:72
	Hours lectures: 72
	Hours self study: 72
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, GIS, statistical software

Kyrgyzstan	
Degree specialist in Geography (other)	

Course: GIS	App. Twice in questionnaire
Objective:	Introduction to GIS, technique and tools of GIS
Learning outcomes:	students can create and analyze various type of maps
	After this course student can create various geographical maps with ArcView
Keywords	Basic concepts of GIS, Structure of GIS, functionality of GIS, GIS in agriculture and geography, relief, cartography
Entry requirements	Computer competence, geography, cartography
Number of students	15 OR 25
Hours total	70 OR 28
	Hours practical classes: 16 OR 8
	Hours lectures: 20 OR 4
	Hours self study: 34 OR 16
Language teaching	Russian, Kyrgyz
Language books, articles, syllabi	Russian, bit English
Software	Office, GIS, statistical

Kyrgyzstan	
Degree specialist in Geography (other)	
Course: Cartography	
Objective:	Map projection. Structure and nomenclature of topographic maps. Attributes of geographic maps
Learning outcomes:	students acquired during this course basic concepts of maps, types of maps(for example, topographical, climatically, political and physical)
Keywords	map projection, geographical map, topographical map, cartographical map, Geographic globe
Entry requirements	geometry, mathematics, physics, art
Number of students	10
Hours total	82
	Hours practical classes:26
	Hours lectures: 30
	Hours self study: 26
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
Degree specialist in Geography (other)	
Course: Physical Geography Issues	
Objective:	study and analysis of physiographic issues, relation between geographic objects and phenomenon, monitoring and forecasting, estimation and natural resources conservation
Learning outcomes:	After this course student can define relationship between objects and phenomenon, use geodatabase, read a various type of map
Keywords	theoretical and practical issues of physic-geography, natural resources conservation, relationship between geophysical phenomenon
Entry requirements	computer competence, cartography, geophysics, mathematics
Number of students	25
Hours total	100
	Hours practical classes:24
	Hours lectures: 30
	Hours self study: 46
Language teaching	
Language books, articles, syllabi	Russian

Software	Office, statistical software

Kyrgyzstan	
Degree Specialist in Geology (master)	
Course: GSRM	
Objective:	The main objectives are to carry out research in the different fields of geology.
Learning outcomes:	They can work as Geologists, Research workers and as well as cartographs.
Keywords	Geological Research for useful managements; Different types of useful researches; Geo-Physical methods of search; Geo-cartography for Radical Geological research; Petrology, Minerology, Geo-Chemistry.
Entry requirements	Background in Physics, Mathematics, Chemistry and Informatics
Number of students	15
Hours total	500
	Hours practical classes: 180
	Hours lectures: 180
	Hours self study: 140
Language teaching	Russian
Language books, articles, syllabi	English, Russian
Software	Office

Kyrgyzstan	
Degree Specialist in Mountain works. (master)	
Course: DMW.	
Objective:	Preparation of the specialists for mountainous works and exploitation researches.
Learning outcomes:	They can work as an Engineer, Constructor, Scientific worker and as well as Technologist.
Keywords	Mountainous Works; Explosive works; Technology for drilling holes; Useful geological explorer; Technology for the surrounding environment.
Entry requirements	background in physics, Mathematics, Informatics and drawing.
Number of students	15
Hours total	500
	Hours practical classes:180
	Hours lectures: 140
	Hours self study: 180
Language teaching	Russian
Language books, articles, syllabi	English, Russian
Software	Office, GIS (Mapinfo, AutoCad), statistical software.

Kyrgyzstan	
Degree specialist in programming (other)	
Course: Technician	
Objective:	Professional computer programming, network administration, web-programming
Learning outcomes:	Computer network specialist, Computer programmer, web master
Keywords	Basic computer skills, C++, HTML, php, javascript, perl, xml, Computer networks, Server technologies.
Entry requirements	Mathematics, physics, informatics
Number of students	15
Hours total	240
	Hours practical classes:80
	Hours lectures: 80
	Hours self study: 80

Language teaching	Russian
Language books, articles, syllabi	Russian (bit English)
Software	Office, statistical software

Kyrgyzstan	
Degree specialist on geology, geodesy (other)	
Course: Geological exploration and mineral survey	
Objective:	Theory of mineral genesis and geology of Kyrgyzstan
Learning outcomes:	At the end of this course the student should possess knowledge and skills by technique of searches, survey of minerals, perform field and laboratory exploratory
Keywords	Minerals, petrology, recycling, concentration,
Entry requirements	physics, chemistry, optics, analytical chemistry, mathematical statistics
Number of students	15
Hours total	141
	Hours practical classes:51
	Hours lectures: 51
	Hours self study: 39
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
Degree Specialists for Engineering Geolology (master)	
Course: DEG	
Objective:	The main objectives are to conduct researches for engineering geological aspects.
Learning outcomes:	They can works as Researchers and Engineers.
Keywords	Engineering Geology, Geo-Physics, Hydro-Geology, Drilling holes, Environmental management
Entry requirements	Background in Physics, Mathematics, Informatics and drawing
Number of students	15
Hours total	500
	Hours practical classes: 180
	Hours lectures: 140
	Hours self study: 180
Language teaching	Russian
Language books, articles, syllabi	Russian (bit English)
Software	Office, GIS (Mapinfo, Arch, AutoCad), statistical

Kyrgyzstan	
Degree specialists in Techniques and exploitation (master)	
Course: TEG	
Objective:	Preparation of Geological Explorers for the exploitation of Geological works.
Learning outcomes:	They can work as engineers, Drilling masters and Teachers.
Keywords	Technology for drilling holes, Technology for the mountainous Researches, Mountainous drilling and explosive works, Use of drilling fluids, Directional drilling
Entry requirements	Background in Physics, Mathematics, Drawing and Informatics.
Number of students	15
Hours total	500
	Hours practical classes:180

	Hours lectures: 140
	Hours self study: 180
Language teaching	Russian
Language books, articles, syllabi	Russian (bit English)
Software	Office, GIS (Mapinfo, Arch, AutoCad), statistical

Kyrgyzstan	
UNKNOWN master	
Course: Methods of space researches	
Objective:	To show importance of space methods of researches in geographical researches
Learning outcomes:	Ability to read space and space shootings and to work with them
Keywords	-
Entry requirements	-
Number of students	-
Hours total	-
	Hours practical classes:-
	Hours lectures: -
	Hours self study: -
Language teaching	Russian
Language books, articles, syllabi	-
Software	Office

Kyrgyzstan	
UNKNOWN master	
Course: Rational use of natural resources in KR	
Objective:	To familiarize students with natural resources and rational use of them. Problems of environment today give us a lot of question and only good specialists in geography can solve them
Learning outcomes:	good user of PC and knowing Russian and English language
Keywords	-
Entry requirements	-
Number of students	-
Hours total	-
	Hours practical classes:-
	Hours lectures: -
	Hours self study: -
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
UNKNOWN master	
Course: Methods of geographical research	
Objective:	To teach basic methods of geographical research. General steps of research a preparing b field c final
Learning outcomes:	-
Keywords	Camera, field-glass, diary, report
Entry requirements	good user of PC, knowing russian and english language
Number of students	5
Hours total	160

	Hours practical classes:46
	Hours lectures: 44
	Hours self study: 70
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
UNKNOWN	
Course: the higher geodesy, applied geodesy	
Objective:	learn how to operate and carry out design and survey works
Learning outcomes:	perform surveying work, use modern instruments to solve the objectives Surveyor
Keywords	applied geodesy
Entry requirements	higher mathematics, descriptive geometry and of Computer Literacy
Number of students	13
Hours total	170
	Hours practical classes:54
	Hours lectures: 46
	Hours self study: 80
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, GIS

Kyrgyzstan	
Master in Geodesy and Geoinformatics	
Course: Cartography, GIS, Topographical bases of a geodesy	
Objective:	Formation at students of cartographical knowledge and ability to work with maps
Learning outcomes:	Ability to work with various maps, drawing up of maps and the district plan
Keywords	Monitoring, Resources, Information, Rationalisation
Entry requirements	
Number of students	5
Hours total	300
	Hours practical classes:130
	Hours lectures: 100
	Hours self study: 20
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, GIS

Kyrgyzstan	
Master in Geology, Electrical Engineering	
Course: Geological Exploitation, Electrical Technition	
Objective:	To make them enable to carry out the research works in the field of Geology and all other different related fields.
Learning outcomes:	Carry out the geological analysis, make projects and exploitation. Planning and estimation of Hydro-Resource potential, Electricity Transportation.
Keywords	Mineral Mining, Geological Research, Ecological analysis; Energy and its uses; Technology and Nature maintenance; Hydrolics; Basic Electric Supply

Entry requirements	Bachelors, or Degree Specialists
Number of students	15
Hours total	240
	Hours practical classes:80
	Hours lectures: 80
	Hours self study: 80
Language teaching	Russian
Language books, articles, syllabi	English / Russian
Software	Office, GIS, statistical software

Kyrgyzstan	
Master in Power Supply	
Course: Power Supply	
Objective:	the main objectives are to prepare the students in the field of transportation and use of electricity
Learning outcomes:	Exploitation, repairing of Electrical networks and grid stations up to 10000 volts.
Keywords	Basic power supply in agriculture, cities and main enterprises; Transportation nad distribution of Electro-Energy to the consumers; Statistics and control of the consuming of Electro-Energy; Basements and foundations of Electrical equipments; Basic exploitation of Electrical equipments
Entry requirements	Solid background in Physics, Mathematics and informatics
Number of students	40
Hours total	500
	Hours practical classes:120
	Hours lectures: 120
	Hours self study: 260
Language teaching	Russian
Language books, articles, syllabi	English / Russian
Software	Office, statistical software

Kyrgyzstan	
Master in Ecology	
Course: GIS in ecology	
Objective:	To gain general knowledge on GIS concept
Learning outcomes:	to be able to use GIS for ecological tasks
Keywords	ESRI, raster, vector, DBMS, GIS history
Entry requirements	computer skills
Number of students	15
Hours total	80
	Hours practical classes:32
	Hours lectures: 32
	Hours self study: 16
Language teaching	Russian and Kyrgyz
Language books, articles, syllabi	Russian
Software	Office, GIS

Kyrgyzstan	
Masters in Ecological Sciences, Programming	
Course: IT specialist	
Objective:	Software Specialists. So that the students can make their own Computer softs in the future.
Learning outcomes:	They can make statistical calculations and mathematical modules in the different fields

	with the help of computer
Keywords	Web-Programming (PHP, HTML, Java, MySQL); Programmiong with Mathematical Packages (Maple, Matlab, MathCAD); Graphical Softwares (3D Max, Photoshop, CorelDraw, Macromedia Flash,); Database (SQL, Access, FoxPro)
Entry requirements	Background in Physics, Mathematics
Number of students	20
Hours total	240
	Hours practical classes:80
	Hours lectures: 80
	Hours self study: 80
Language teaching	Russian
Language books, articles, syllabi	English / Russian
Software	Office, GIS, Statistical software

Kyrgyzstan	
Specialist (Bachelor) in Water managment	
Course: GIS and monitoring of water resource	
Objective:	Studying types of monitoring of water resource, introduction in GIS, data base management, remote sensing
Learning outcomes:	Students must: know basic system of water resource monitoring in Russia and Kyrgyzstan, have skills work with GIS software (ArcGis, QGIS, gvSIG) i.e. digitizing and editing, DEM and spatial analysis, database management, GPS, classification of satellite image, some basic skill for hydrological modelling.
Keywords	Monitoring of water resource; GIS; Data Base Management System: Remote Sensing, DEM
Entry requirements	Knowledge of geodesy and cartography, mathematics, statistics analysis, informatics (operational system and base of programming), hydrology
Number of students	17
Hours total	95
	Hours practical classes:34
	Hours lectures: 17
	Hours self study: 34
Language teaching	Russian
Language books, articles, syllabi	Russian
Software	Office, GIS

Kyrgyzstan	
Higher professional education in geography	
Course: Hydrology	
Objective:	concept of the hydrosphere, water objects and their location and rational use
Learning outcomes:	Students should have knowledge about water resources, water bodies, their location and distribution, to work with geographic atlases and hydrological nomenclature, have the skills geographical mapping water objects
Keywords	Water objects and classification; Water resources management and protection; Hydrosphere; Geography; Oceanology
Entry requirements	This course is mandatory for the curriculum and is studied by all students
Number of students	14
Hours total	110
	Hours practical classes:26
	Hours lectures: 30
	Hours self study: 54
Language teaching	Kyrgyz

Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
UNKNOWN (higher education)	
Course: cartography	
Objective:	to determine the conditions for tourism on the map
Learning outcomes:	eco -tourism
Keywords	Geography of Soils; Cartography; Continents, oceans
Entry requirements	-
Number of students	12
Hours total	40
	Hours practical classes:20
	Hours lectures: 20
	Hours self study: 0
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
UNKNOWN (higher education)	
Course: geographic population	
Objective:	preparation and structure of the population race, types
Learning outcomes:	-
Keywords	Population, race, place
Entry requirements	-
Number of students	10
Hours total	38
	Hours practical classes:6
	Hours lectures: 24
	Hours self study: 4
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
UNKNOWN (higher education)	
Course: Ecology Tourism	
Objective:	eco-tourism and the global problems,trends and prospects of development of ecological tourism
Learning outcomes:	environmental geography and basic principles
Keywords	Eco-Tourism; Mapping of eco-tourism; The basic principles of eco-tourism; Resources and types of eco-tourism
Entry requirements	Geography, ecology
Number of students	12
Hours total	48
	Hours practical classes:22
	Hours lectures: 26
	Hours self study: 0
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
UNKNOWN (higher education)	
Course: Economics - Social Geography	
Objective:	social situation and economy of the CIS
Learning outcomes:	Students should know maps, signs relating with the map,can work with map
Keywords	social position; economics; map
Entry requirements	-
Number of students	12
Hours total	38
	Hours practical classes: 6
	Hours lectures: 24
	Hours self study: 4
Language teaching	Kyrgyz
Language books, articles, syllabi	Russian
Software	Office

Kyrgyzstan	
secondary technical education for construction	
Course: geodesy	
Objective:	teach students to use the tools to take reports on appliances, office analysis of data, graphical plotting profiles and removal project in the nature
Learning outcomes:	must learn to use tools, to take reports to monitor data processing
Keywords	Teodolit; nivelir; longitudinal profile; Azimut
Entry requirements	knowledge on the basis of secondary education
Number of students	15
Hours total	239
	Hours practical classes: 112
	Hours lectures: 69
	Hours self study: 58
Language teaching	
Language books, articles, syllabi	
Software	

Annex B: Course descriptions potential teachers Kazakhstan

Kazakhstan	Courses taught by potential GEM teachers
Course	photogrammetric
Study program	photogrammetric, geography
Learning objectives	Studying of the basic questions of the theory photographic and its applications at creation of topographic maps and plans on aero-and to space shootings, geodetic researches, designing and operation of engineering constructions
Learning outcomes	aero-and space shooting; the Theory single and steams of pictures, stereo-model construction; definition of spatial co-ordinates of points of district on pictures, photogrammetric system of coordinates; transformation of pictures and technology of creation of cards and photo-plans; a phototriangulation; processing pictures; remote methods
Keywords	aero-and space shooting; ortophototransformation; stereomodel construction; mapping
Study load	140
Used computer programs	Office, GIS (ArcMap), statistical software (excel), AutoCAD

Kazakhstan	Courses taught by potential GEM teachers
Course	Modelling
Study program	In Geography
Learning objectives	Models in geography?
Learning outcomes	Learns models, create модел investigated territory?
Keywords	Model; Creation a database;
Study load	2
Used computer programs	Office, GIS, Statistical software

Kazakhstan	Courses taught by potential GEM teachers
Course	GIS fundamentals in nature development
Study program	Engineering systems of irrigation
Learning objectives	To understand the principles, trends, and pertinent issues of GIS. To develop technical skills and competence in data and information acquisition and analysis
Learning outcomes	Student should be able to develop data layers, to do basic analysis, create maps to pesent result of their work.
Keywords	Digitizing; vector data; raster; overlay; coordinate system
Study load	36
Used computer programs	GIS (ArcGIS)

Kazakhstan	Courses taught by potential GEM teachers
Course	Geodetic networks
Study program	Master in Geodesy and Geoinformatics
Learning objectives	To teach students on principles of the building of the geodetic networks, defining main and elevation coordinates of geodetic stations, selecting methods of the creation geodetic network and fixing the points of the geodetic networks on location.
Learning outcomes	1. Principle of the building of the geodetic networks, types, ways and precision of the measurements, executed when making the geodetic network on location. 2. How defined main and elevation coordinates of the points geodetic station.

	3. Methods of the creation geodetic network.
	4. How select the most optimum method of the creation to geodetic network at well-defined condition on location.
	5. Ways of the processing result measuring.
	6. Fixing the points of the geodetic networks on location.
	7. Forming catalogs of the coordinates and elevation points.
Keywords	geodetic networks; coordninates of stations; coordinate systems; WGS-84; Pulkovo 1942
Study load	28
Used computer programs	Office, ArcGIS, Statistical software (Leica Geo Office)

Kazakhstan	Courses taught by potential GEM teachers
Course	Digital cartography
Study program	Bachelor in Geodesy and cartography
Learning objectives	Creating digital maps for navigation systems, converting digital maps to other formats
Learning outcomes	creating and updating topographic maps,rapid detection and monitoring of oil pollution, rapid assessment of the state of ice and snow
Keywords	Raster, vector, space images, interpretation, databases
Study load	30
Used computer programs	-

Kazakhstan	Courses taught by potential GEM teachers
Course	Digital cartography
Study program	Bachelor in Geodesy and cartography
Learning objectives	creating and updating topographic maps,disaster monitoring,Natural Resources Exploration
Learning outcomes	processing of geographic data on GIS programms
Keywords	Raster, vector, annotation, shape, design of map
Study load	60
Used computer programs	ArcGIS

Kazakhstan	Courses taught by potential GEM teachers
Course	The general cartography
Study program	On a geodesy and geoinformatics
Learning objectives	Acquaintance of students with a complex of knowledge of properties of cards, methods of their creation and use
Learning outcomes	To be able to read and "remove" the necessary information from a card, using it Information capacity, and creatively to analyze it; - Principal views and types of cartography products, and ways of their creation;
Keywords	Mapping The analysis Drawing up Editing
Study load	68
Used computer programs	Word, ArcMap, Excell, AutoCAD

Kazakhstan	Courses taught by potential GEM teachers
Course	Geoinformatics, GIS in cartography
Study program	Bachelor and Master in Geography
Learning objectives	to study and work GIS programme, mapping with GIS Spatial analysis.
Learning outcomes	to manage database, to analyse and projecting of geographical data.
Keywords	spatial analysis; database; GIS software; Shapefile

Study load	90
Used computer programs	MS Office, ArcGIS

Kazakhstan	Courses taught by potential GEM teachers
Course	GIS IN GEOGRAPHY
Study program	Master in Geodesy and Geoinformatics
Learning objectives	Geography
Learning outcomes	Geographical laws?
Keywords	Geographical laws; GIS; ecology
Study load	3
Used computer programs	Standard office; GIS, statistical software

Kazakhstan	Courses taught by potential GEM teachers
Course	GIS
Study program	Master in geodesy and geoinformatics
Learning objectives	To use geoinformatics in geography
Learning outcomes	-
Keywords	Geography; education; geoinformation; research; practics
Study load	1
Used computer programs	Office, ArcView, statistical software (Amadeus), Mapinfo

Kazakhstan	Courses taught by potential GEM teachers
Course	GIS in the tourism
Study program	tourism
Learning objectives	Bases GIS-technology and their use in various spheres
Learning outcomes	Upon termination of a course students should construct cards on a tourist infrastructure, hotels, natural and social tourist resources
Keywords	GIS-technology; databases; GIS-technology structure; MapInfo; CorelDraw
Study load	19
Used computer programs	Microsoft Office, Excel, Access; CorelDraw, MapInfo; model construction in geo-ecology sphere; some experience with HTML

Kazakhstan	Courses taught by potential GEM teachers
Course	Remote Sensing
Study program	Engineering systems of irrigation
Learning objectives	To understand the principles and pertinent issues of remote sensing (RS). To develop skills and competence in data and information acquisition.
Learning outcomes	They will have overview of available RS data. And be able to do visual interpretation, to extract information.
Keywords	Satellite; Sensors; Resolution; Bands; Spectral signature
Study load	36
Used computer programs	ArcGIS

Kazakhstan	Courses taught by potential GEM teachers
Course	Modern foreign technologies
Study program	Bachelor in Economy

Learning objectives	The basic concepts of geo-information technologies
Learning outcomes	The competences students work with ArcGIS, should know type of data and should be able to create correct map.
Keywords	GIS, Raster and Vector data, Attribute, Layer, Spatial tools,Buffer, Intersection, Map, Scale
Study load	72
Used computer programs	Microsoft office; ArcGis; R, Suffer

Kazakhstan	Courses taught by potential GEM teachers
Course	GIS in hydrology, Mathematic modeling in hydrology
Study program	Bachelor in hydrology, Master in hydrology
Learning objectives	Modeling of hydrological processes with the using of GIS
Learning outcomes	Vectorization of raster images, creating of thematic maps, modeling in GIS.
Keywords	Vectorization ; Hydrology; Hydrography; Map a runoff; Three-dimensional modeling
Study load	45
Used computer programs	Mapinfo

Kazakhstan	Courses taught by potential GEM teachers
Course	Design and Development of GIS
Study program	Master in Geodesy and Geoinformatics
Learning objectives	Within the framework of an applied real-world project students will work in small teams to design and implement an application for an external stakeholder or customer. Students need to assess and evaluate customer needs, discuss a pathway towards a solution and agree on a joint strategy.
Learning outcomes	students should be able: - to design GIS in different levels (global, national, regional, local); - to bring acquired conceptual and developmental (software) skills to fruition within the framework of an integrated project; - to recognize the importance of structured development frameworks and toolsets; - to acknowledge the coordination efforts required for team-based development; - to appreciate the value of a sound design process and methodology.
Keywords	Geoinformation system; GIS project; Logical Framework Matrix
Study load	44
Used computer programs	MS Office, ArcIS

Kazakhstan	Courses taught by potential GEM teachers
Course	Geoinformatics
Study program	Bachelor in Applied Informatics on Geoinformatics
Learning objectives	The concepts of Geoinformation Systems; Geodatabase development and management; Data acquisition and data modelling; Spatial data visualisation; Spatial analysis
Learning outcomes	The deep knowledge on GIS; understanding the differences between Information and Geoinformation Technologies; obtaining GIS software skills; selection of coordinate systems and georeferencing; use of GPS devices for surveying; Satellite image analysis; ability on spatial data modelling and analysis; GIS Project management; Web GIS programming;
Keywords	GIS; Georeferencing; GPS Technology; Satellite image analsys; spatial analysis
Study load	210
Used computer programs	Office; ArcGIS; Idrisi;QGIS; MapServer;PC Geomatics

Kazakhstan	Courses taught by potential GEM teachers
Course	Geo-informatics
Study program	Bachelor in Geodesy and cartography 40

Learning objectives	principles of GIS, their structure, methods of data processing
Learning outcomes	main aim of GIS, to construct thematic maps with use GIS programs
Keywords	raster vector annotation 3D view multimedia
Study load	30
Used computer programs	GIS software

Kazakhstan	Courses taught by potential GEM teachers
Course	Geo-informatics
Study program	Bachelor in Geodesy and cartography 90
Learning objectives	show the prospects of using geographic information systems (GIS) geographical research and learn the basics of building geographic information systems for solving various problems of geography, principles of GIS, their structure, methods of data processing
Learning outcomes	main aim of GIS, to construct thematic maps with use GIS programs
Keywords	GIS raster, vector, data of RS multimedia, 3D view
Study load	60
Used computer programs	MapInfo, ArcGIS

Annex C: Course descriptions potential teachers Kyrgyzstan

Kyrgyzstan	Courses taught by potential GEM teachers
Course	photogrammetry
Study program	Higher education in Geodesy
Learning objectives	Studying of the basic questions of the theory photogrammetric and its applications at creation of topographic maps and plans on aero-and to space shootings, geodetic researches, designing and operation of engineering constructions
Learning outcomes	aero-and space shooting; the Theory single and steams of pictures, stereomodel construction; definition of spatial co-ordinates of points of district on pictures, photogrammetric system of coordinates; transformation of pictures and technology of creation of maps and photoplans; a phototriangulation; processing pictures; remote methods
Keywords	Remote method Space Phototriangulation Photoplans
Study load	20
Used computer programs	Office, GIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	basis of geodesy
Study program	Bachelor in Civil Engineering
Learning objectives	learn how to design, review methods of surveying
Learning outcomes	working with map and work with surveying instruments
Keywords	teodolite nivelir taheometr
Study load	68
Used computer programs	Office

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Geodetic astronomy
Study program	Bachelor in Geodesy
Learning objectives	coordinate system, system of time measurement
Learning outcomes	determine the azimuth of the sun, determine a longitude points
Keywords	navigational triangle; world, grinvich, local time; equation of time
Study load	54
Used computer programs	Office

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Geo-informatic Systems
Study program	Bachelor in Geo-informatics
Learning objectives	Creating maps for analysis of GIS potential of the region.
Learning outcomes	Obtain skills in reading maps and apply in practice
Keywords	Digital model ; Methods of interpolation; diagram; Scale
Study load	45
Used computer programs	GIS (Mapinfo, CREDO, AutoCAD)
Kyrgyzstan	Courses taught by potential GEM teachers
Course	Automated Cartography methods

Study program	Bachelor in Geodesy and Cartography
Learning objectives	using automated Cartography methods for mapping and analysis
Learning outcomes	ability to use automated Cartography methods for mapping and analysis
Keywords	Automation Cartography Mapping Automatic RS data interpretation
Study load	30
Used computer programs	Office (MS Word, MS Power point, MS Excel), Easy Trace 7.99, ENVI 4.7

Kyrgyzstan	Courses taught by potential GEM teachers
Course	GIS in cadastre
Study program	Bachelor in Cadastre
Learning objectives	Training to the program GIS
Learning outcomes	the Vectoring, processing and editing of the GIS-data
Keywords	GIS-data Network Analysis the Vectoring
Study load	2
Used computer programs	ArcGIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	geodesy
Study program	high in Geodesy
Learning objectives	Acquaintance of students with a complex of knowledge of properties of cards, methods of their creation and use
Learning outcomes	To be able to read and "remove" the necessary information from a card, using it. Information capacity, and creatively to analyze it; - Principal views and types of cartographical products, and ways of their creation;
Keywords	Mapping The analysis Drawing up Editing
Study load	30
Used computer programs	Office, GIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Geodesy bases
Study program	Higher in Architecture
Learning objectives	Acquaintance with geodetic equipments and work with them.
Learning outcomes	Initial knowledge on work with nivelirs, theodolites and taheometrs.
Keywords	Coordinate Corners Height Distance
Study load	30
Used computer programs	Office

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Engineering Geodesy
Study program	Higher education in geodesy
Learning objectives	viewing statements and surveying techniques necessary to design the construction and operation of engineering structures
Learning outcomes	ability to work with topographic maps possession surveying instruments with theodolites,nivelirs and gps
Keywords	Absolute mark, geoid; Graphics and Numbering; teodolite nivelir taheometr
Study load	68
Used computer programs	Office, GIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	The general cartography
Study program	Bachelor in geodesy
Learning objectives	map projections, methods of creating and mapping
Learning outcomes	Mapping of a conventional sign, preparation for publication
Keywords	map plan cartography conventional signs
Study load	54
Used computer programs	Office

Kyrgyzstan	Courses taught by potential GEM teachers
Course	geodesy
Study program	bachelor in geodesy
Learning objectives	Introduction in GIS. To prepare students for effective work with maps
Learning outcomes	
Keywords	Editing Spatial data Coordinate system georeference map
Study load	100
Used computer programs	Excel, Access ; ArcGIS9.2

Kyrgyzstan	Courses taught by potential GEM teachers
Course	GeoDatabase and Distributed Architectures
Study program	Master in Geoinformatics
Learning objectives	Work with base of GeoData Geoprocessing and analyse in ArcGIS Creating web-cartography
Learning outcomes	In general concept and abilities to work with GeoDatabase To abilities to work with Geo analyses and processing To possess knowledge for creation web-cartography
Keywords	geodatabase ;attribute; clip, select, intersect, buffer, overlay and editing ;mapfile layer; shapepath, extent and projection
Study load	37
Used computer programs	Word, Excel, PowerPoint; ArcGIS, MapServer, PostgreSQL, QGIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Cartography
Study program	Bachelor in Land Management
Learning objectives	Creating and multiplying thematic maps
Learning outcomes	Obtain skills in making maps
Keywords	Digital model Calculating functions Generalization Acrolandscape
Study load	45
Used computer programs	GIS (Mapinfo, CREDO, AutoCAD)

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Soil Studies
Study program	Bachelor in Land Management
Learning objectives	to teach students making soil maps
Learning outcomes	skills and competences in making soil maps
Keywords	soil ;environment; land resources ; cartogramme

Study load	70
Used computer programs	GIS (MApinfo, land plan, CREDO, AutoCAD)

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Land Management Design
Study program	Bachelor in Land Management
Learning objectives	To teach students to learn principles and methods of automated land management design
Learning outcomes	obtain skills and competences in automated land management design and its digital modelling
Keywords	land management ;digital modelling ; cadastre ; mapping
Study load	90
Used computer programs	Digital modeling, CREDO, AutoCAD

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Applied Geodesy
Study program	Bachelor in Geoinformatics
Learning objectives	to teach students to learn making maps of agricultural firms
Learning outcomes	competences in making maps, technologies and ways of operative map making skills
Keywords	mapping ; digital model; landscape; distance probıng
Study load	90
Used computer programs	CREDO, AutoCAD

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Cartography
Study program	Bachelor in Land Management
Learning objectives	Creating and multiplying thematic maps
Learning outcomes	Obtain skills in making maps
Keywords	Digital model; Calculating functions ; Generalization Acrolandscape
Study load	45
Used computer programs	Mapinfo, CREDO, AutoCAD

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Land Management Design
Study program	Bachelor in Land Management
Learning objectives	To teach students to learn principles and methods of automated land management design
Learning outcomes	obtain skills and competences in automated land management design and its digital modelling
Keywords	land management digital modelling cadastre mapping
Study load	90
Used computer programs	Digital modelling, CREDO, AutoCAD

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Applied Geodesy
Study program	Bachelor in Geoinformatics
Learning objectives	to teach students to learn making maps of agricultural firms
Learning outcomes	competences in making maps, technologies and ways of operative map making skills
Keywords	mapping digital model landscape distance probng

Study load	90
Used computer programs	CREDO, AutoCAD

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Geoinformatics
Study program	Bachelor in Geoinformatics
Learning objectives	Introduction to GIS, to train students effectively use GIS in solving not only local but global ecological problems
Learning outcomes	To use spatial data, 3d analyze, ArcToolbox- analize, edit, to create map.
Keywords	spatial data3d modelling, vizualization ; editing ; spatial analyze ; Coordinate system
Study load	34
Used computer programs	Office, Excel,Access, ArcGIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	introduction GIS
Study program	computer science
Learning objectives	To enter and change the attributive geo data given in base
Learning outcomes	Should possess knowledge of the personal computer, 3D analysis, to improve skills of application of geo-information technologies, to master bases of the geographical analysis
Keywords	Polygon Diagram Attribute Buffer Map
Study load	27
Used computer programs	Office (Excel, Access), ArcGIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Introduction GIS
Study program	ecology, informatics, constructing engineers
Learning objectives	The subject is focused on formation at students of skills and ability of practical activities in the field of a geo-information science and technology
Learning outcomes	Students should acquire the major GIS aspects and the organisation of modern technologies of storage and processing of spatial data, to seize skills of application of geo-information technologies
Keywords	buffering maps and layers line, point, polygon editting
Study load	27
Used computer programs	Office (Excel, Access), ArcGIS

Kyrgyzstan	Courses taught by potential GEM teachers
Course	geography
Study program	Bachelor in geography
Learning objectives	-Identify what landforms and rivers are found in Kazakhstan; Understand what factors influence the region's climates and vegetation; Identify what natural resources the region has; Explain some of the major events in the growth of the Kazakhstan
Learning outcomes	-Demonstrate knowledge of the basic concepts of physical and human geography; -Have an understanding of the nature of Geography as an academic discipline, including familiarity with its history and principal subfields; - Demonstrate a competency in sel
Keywords	Landforms ; Vegetation Human geography; Geographic techniques
Study load	135

Used computer programs	AutoCAD, CREDO

Kyrgyzstan	Courses taught by potential GEM teachers
Course	GIS in Geomorphology
Study program	Bachelor in Geography
Learning objectives	to analyze relief using GIS software
Learning outcomes	ability to map and to analyze relief
Keywords	Geomorphology relief GIS mapping DEM
Study load	30
Used computer programs	Office (MS Word, MS Power point, MS Excel), ArcGIS 9.2-9.3

Kyrgyzstan	Courses taught by potential GEM teachers
Course	using GIS in Geomorphology
Study program	Bachelor in Geography
Learning objectives	Aspects of using GIS technologies for relief analysis
Learning outcomes	Ability of students to create relief maps, as digital, so paper copies
Keywords	Geomorphology GIS DEM Relief Analysis
Study load	30
Used computer programs	Microsoft Word, Microsoft Power point ArcGIS 9.2, 9.3, ENVI 4.7

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Geodesy
Study program	Bachelor in Geodesy
Learning objectives	-
Learning outcomes	-Describe a range of geodetic measurement techniques and instruments Understand the determination of local geodetic datums in GPS networks; understand selected advanced geodesy topics such as applications of space technologies for high precision position
Keywords	Satellites Global Positioning System (GPS) Digital databases ; Survey
Study load	135
Used computer programs	AutoCAD, CREDO

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Using GIS technologies in modern cartography
Study program	Master in Geography, Master in Geodesy and Geoinfo
Learning objectives	To use GIS&T in mapping and analyzing data
Learning outcomes	Gain skills and be able to GIS technologies and solve the problem in the sphere geography
Keywords	mapping digital maps GIS software analysing data; assesment
Study load	10
Used computer programs	Office, GIS (need)

Kyrgyzstan	Courses taught by potential GEM teachers
Course	Spatial Analys, GIS in cartography
Study program	Bachelor in Geography
Learning objectives	Training to bases of GIS

Learning outcomes	the Vectoring, processing and editing of the GIS-data Working out of structure of geodatabase ArcGIS
Keywords	Vectoring ; geodatabase; GIS-data
Study load	3
Used computer programs	ArcGIS 9.3