Program: Doctor of Philosophy Program in Geoinformatics (International Program)
Degree: Doctor of Philosophy (Geoinformatics)
Study Plan:

1) Research Program (Scheme 1.1: for Master's Degree holder)

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	Ph.D. Thesis	1-3	Ph.D. Thesis	3-5	Ph.D. Thesis	3-5
	Seminar 1	1				
	Total	**2-4**	**Total**	**3-5**	**Total**	**3-5**
Year 2	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
	Total	**3-15**	**Total**	**3-15**	**Total**	**3-15**
Year 3	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
					Seminar 2	1
	Total	**3-15**	**Total**	**3-15**	**Total**	**4-16**

2) Regular Program (Scheme 2.1: for Master's Degree holder)

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	Core Course	8	Elective Course	10	Seminar 1	1
					Ph.D. Thesis	1-3
	Total	**8**	**Total**	**10**	**Total**	**2-4**
Year 2	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
	Total	**3-15**	**Total**	**3-15**	**Total**	**3-15**
Year 3	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
					Seminar 2	1
	Total	**3-15**	**Total**	**3-15**	**Total**	**4-16**

3) Regular Program (Scheme 2.2: for Bachelor's Degree holder)

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	Core Course	12	Core Course	4	Elective Course	8
			Elective Course	6		
	Total	**4/12**	**Total**	**4/12**	**Total**	**4/12**
Year 2	Seminar 1	1	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
	Ph.D. Thesis	1-3				
	Total	**2-4**	**Total**	**3-15**	**Total**	**3-15**
Year 3	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
	Total	**3-15**	**Total**	**3-15**	**Total**	**3-15**
Year 4	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
	Total	**3-15**	**Total**	**3-15**	**Total**	**3-15**
Year 5	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15	Ph.D. Thesis	3-15
					Seminar 2	1
	Total	**3-15**	**Total**	**3-15**	**Total**	**4-16**

Program: Doctor of Philosophy Program in Geoinformatics (International Program)
Degree: Doctor of Philosophy (Geoinformatics)
Course Description:

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
Core Course				
106801 Advanced Remote Sensing	4(4-4-12)	None	This course aims to study remote sensing theories and application in various aspects. These include, in particular, origin/development of key remote sensing systems, principles of remote sensing systems regarding types of sensor, platform, and target e.g. (1) ground-based, airborne, spaceborne; and (2) sea/ocean, atmosphere, space remote sensing. Applications of remote sensing in different fields, general information on main resources of data and tools for advanced remote sensing research/applications, and key progresses in advanced remote sensings topics nowadays are also discussed.	1. Explain origin and development of remote sensing science conceptually 2. Explain principles of remote sensing regarding types of sensor, platform, targer area 3. Explain principles of ground-based, airborne, spaceborne remote sensing 4. Analyze advances in study/research on remote sensing nowadays 5. Apply remote sensing science in the study of given topic

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106802	Advanced Digital Image Analysis and Interpretation	4(3-3-10)	None	This course provides essential principles of object-based image analysis from very high spatial resolution remotely sensed data. In addition, public and commercial digital image processing software are introduced and exercised on pixel-based image analysis in this course with individual semester assignment and presentation. The specific topic of course outline includes (1) principle of object-based image analysis, (2) data collection and image preprocessing, (3) basics of image segmentation and image object construction, (4) optimum feature selection for object-based image classification, (5) object-based image classification, (6) accuracy assessment, and (7) object-based change detection.	1. Explain principle and algorithm of object-based image analysis 2. Explain basic of image segmentation and feature selection 3. Apply digital image processing software for the image segmentation, classification, accuracy assessment, and digital change detection 4. Integrate knowledge about object-based image analysis in practice

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106803	Advanced Geographic Information System	4(3-3-10)	None	Theories relating to geographic information system (GIS), metadata, spatial database design, advanced techniques in spatial analysis, geographic quantitative methods, interpolation, topographic data analysis, hydrology, spatial modeling, discussion and assessment of previous studies using geographic information system as a tool, development of an individual research project, report writing and presentation	1. Explain theories relating to geographic information system 2. Design a spatial database 3. Analyze spatial data using advanced techniques 4. Create spatial model 5. Develop a research project applying geographic information system
Elective Course					

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106711	Microwave Remote Sensing and Lidar	4(4-0-12)	106801 Advanced Remote Sensing or by concent of the school	This course aims to study radar and lidar systems in various topics. These include, in particular, their origins and past development, their working principles (especially for imaging radar), airborne and spaceborne remote sensing of these instruments, as well as their crucial applications at present. Passive microwave remote sensing is also discussed herein.	1. Explain origins and development of radar and lidar systems conceptually 2. Explain working principles of the given radar/lidar system (especially imaging radar) 3. Explain principles of airborne/spaceborne remote sensing of radar/lidar systems 4. Apply radar or lidar sciences to fulfill assigned study topics effectively 5. Analyze advances in science and roles of passive microwave remote sensing 6. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments.

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106712	Hyperspectral Remote Sensing and Applications	4(4-0-12)	None	This course provides essential principles of hyperspectral remote sensing system and its applications. Also, public and commercial image processing softwares are introduced and applied on hyperspectral image classification along with individual assignment/presentation. Specific topics include (1) principles of hyperspectral remote sensing, (2) data collection and spectral library construction, (3) hyperspectral image preprocessing, (4) hyperspectral image classification algorithms, (5) hyperspectral image classification and accuracy assessment.	1. Explain principles of hyperspectral remote sensing and its applications. 2. Apply image processing softwares for spectral library construction, hyperspectral image preprocessing, image classification and accuracy assessment. 3. Integrate yielded knowledge on hyperspectral remote sensing in practice.

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106713	Remote Sensing of Earth's Surface and Atmosphere	4(4-0-12)	106801 Advanced Remote Sensing or by concent of the school	This course aims to study various topics about remote sensing of the earth's surface and atmosphere. These includes, in particular, origin and development of relevant science, principles of remote sensing regarding used spectral bands and target locations (atmosphere, sea/ocean, land). Applications of remote sensing to achieve effective management in various fields, especially in natural resources/environmental management and city/its environment management, are also presented herein.	1. Explain origin and development of earth's surface/atmosphere remote sensing 2. Explain principles of remote sensing regarding spectral bands and target locations (atmosphere, sea/ocean, land) 3. Apply remote sensing to aid effective study of the considered management topics/ issues (especially on natural resources and environment and city/its environment) 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106714	GNSS: Theory and Applications	4(3-3-10)	None	This course aims to study theories and applications of the GNSS (Global Navigation Satellite System) in various aspects. These include, in particular, origin and development of GNSS, working principles of GNSS satellites and the receivers (especially the Navstar system), principles of efficiency enhancement for receivers (especially errors reduction). Applications of GNSS satellites and receivers on different fields nowadays are also presented herein.	1. Explain origin and development of GNSS technology conceptually 2. Explain working principles of GNSS satellites/receivers (focused on Navstar system) 3. Explain principles of efficiency enhancement for receivers 4. Apply GNSS science/receivers to aid effective study of the considered topics 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments
106715	Geoinformatics for Field Study and Research	4(4-0-12)	None	This course aims to explore applications of geoinformatics to field study and research in various aspects. These include, in particular, principles of field survey and data collection, applications of geoinformatics tools (like GPS receiver) in key field survey activities (e.g., data recording, mapping, terrain analysis), and field survey and statistical data analysis practices.	1. Explain comprehensive roles of geoinformatics in field study and research 2. Apply geoinformatics tools (like GPS receiver/maps) in field survey effectively 3. Analyze and process data from field survey to fulfil the set objectives

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106716	Computer Programming for Geoinformatics Applications	4(3-3-10)	None	This course is designed to provide essential knowledge on computer programing and its applications to large-scale Geoinformatics study/research. Study topics include principles of computer programming and its applications to remote sensing and GIS fields, processing of raster/vector data, and automatic map production. In addition, computer programming practice/training in laboratory are also incorporated as well as the small project assignments to be fulfilled by students.	1. Describe essential knowledge on computer programming 2. Apply and relate computer programming to raster data or satellite image 3. Apply and relate computer programming to vector data or geometric shape 4. Apply and relate computer programming to mapping or cartography 5. Create computer program to solve practical problems in geoinformatics
106717	Spatial Decision Support System and Multi-criteria Decision Analysis	4(3-3-10)	106803 Advanced Geographic Information System or by consent of the school	This course aims to illustrate the integration of GIS and multi-criteria decision analysis (MCDA) for spatial decision support. Main course content includes creation of the decision criteria, decision alternatives and constraints, criteria weighting techniques, decision rules, sensitivity analysis, and result representation in spatial information form to support effective executive decision making.	1. Explain principles of multi-criteria decision analysis combined with GIS 2. Use decision criteria and alternatives 3. Examine constraints and criterion weights 4. Review decision rules to apply in a research 5. Develop a research project applying spatial decision support system and MCDA

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106718	Applied Statistics for Geoinformatics Research	4(3-3-10)	None	Main aim of this course is to study utilization of statistical methods for geoinformatics data analysis whose notable ones include spatial sampling, sampling network design, spatial pattern analysis, spatial autocorrelation analysis, multi-distance spatial cluster analysis, spatial outlier and hotspot analysis, geographic distribution measurement, semivariogram construction and interpretation, covariance/crosscovariance analysis, spatial interpolation and accuracy assessment, global and local spatial regression analysis.	1. Explain principles of spatial statistical analyses 2. Interpret results of spatial statistical analyses 3. Analyze advantages/drawbacks of statistics applied to various types of spatial data 4. Review statistical methods to apply in a research 5. Develop a geoinformatics research project applying spatial statistics
106719	Geospatial Database Management System and GIS Standards	4(3-3-10)	None	This course focuses on geospatial database management system with GIS standards. Main topics cover concept and architect of geospatial database, spatial database standards, inserting various data into the geospatial database, spatial data query, and analysis, database design and creation. Hands-on demonstrations of relevant softwares on geospatial database management are also given in the laboratory.	1. Describe concept and architect of geospatial database 2. Describe spatial database standards 3. Relate and apply gained knowledge to insert various data into geospatial database 4. Relate and apply gained knowledge to query and analyze spatial data 5. Relate and apply gained knowledge to design and create geospatial database

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106721	Geoinformatics Data and Information Services through Modern Media	4(3-3-10)	None	Main aim of this course is to study about geoinformatics data/information services via modern media. Main topics shall cover geoinformatics data and information through modern media with ISO, Mash-Up Map Application, Web Map Service management, Designing and modifying of user interface for GIS Internet. Practices on geoinformatics data and information services via internet are also performed in the laboratory.	1. Describe geoinformatics data and information through modern media 2. Apply geoinformatics data and information through modern media 3. Apply Mash-Up Map Application 4. Apply Web Map Service management 5. Apply the design and modification of user interface for internet GIS
106811	Advanced digital photogrammetry and 3D modelling	4(3-3-10)	106803 Advanced Geographic Information System or by consent of the school	This course aims to describe principle theory of Photogrammetry, object modelling, and 2D and 3D modelling. This course also contains description illustrated both dimension measurement and labelling of 3D model using AutoCAD program. The student is required to perform a project presenting flight lines and rectification of high-resolution image mapping from UAV over the campus	1. Explain principle theory of advanced digital photogrammetry 2. Adjust and rectify the high-resolution images for UAV mapping effectively 3. Generate 3D model or 2D and 3D spatial model accurately 4. Give the information of object model in 2D and 3D using AutoCAD 5. Produce high-resolution map, object model, and 2D/3D spatial model accurately

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106812	Advanced Spatial Data Analysis	4(3-3-10)	106803 Advanced Geographic Information System or by consent of the school	This course aims to enhance knowledge of the spatial modelling principles and their applications on some spatial issues including tendency prediction of the specific phenomena regarding continuous input data in use. Comprehensive discussion about the directions and tendency of spatial model applications (considering quality of the applied spatial data along with the implemented modelling tools) is also presented therein.	1. Explain characteristics and types of geoinformatics data 2. Implement the functions and algorithm with the spatial issues appropriately 3. Develop slope, aspects and terrain models using different kinds of digital elevation models (DEM) 4. Develop images from continuous data with reliable qualified results 5. Apply appropriate spatial models to fulfilled given objectives
106813	Advanced spatial modelling: Theory and Applications	4(3-3-10)	106803 Advanced Geographic Information System and 106812 Advanced Spatial Data Analysis or by consent of the school	This course aims to enhance knowledge of advanced surface modelling in two and three dimensions based on mathematical algorithm and models by using advanced spatial modelling application in GIS. In addition, students are required to analyze surface modelling and present a project by using advanced spatial modelling functions in this course also.	1. Explain relationships of location and phenomena regarding different topography 2. Implement the spatial analysis tools in GIS proficiently 3. Explain functions and give reasons in adjusting parameters of the spatial models accurately 4. Apply the spatial models appropriately to fulfill the assigned project 5. Analyze and give reasons to support the analyzed results of spatial 3D model with a guideline of appropriated solutions

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106814	Big Data Analytics for Advanced Geoinformatics Applications	4(3-3-10)	None	This course focuses on big data analysis applications for geoinformatics problem with large-scale data. Main topics include concept of big data, processing pipelines for big data, techniques for big data analysis, and applications of big data analysis tools like ApacheSpark and MapReduce. In addition, big data analytics for some geoinformatics applications shall be demonstrated wherein students shall gain experience through laboratory practices on various examples. Small assigned project is needed to be fulfilled by each student also.	1. Describe the concept and characteristics of big data 2. Describe data processing pipelines for big data 3. Describe data analysis techniques for big data 4. Apply appropriate data analysis techniques to large-scale data 5. Apply big data analysis tools, i.e., ApacheSpark and MapReduce, to large-scale data 6. Apply big data analytics to geoinformatics problems

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106815	Machine Learning for Advanced Geoinformatics Solution	4(3-3-10)	None	This course focuses on machine learning concept and technology and its applications for solving current geoinformatics problems. Main topics include machine learning principles; supervised classification, such as Support Vector Machine (SVM); unsupervised classification, such as self-organizing map (SOM); linear regression methods such as least square regression (LSR); non-linear regression methods like gradient descent (GD); and dimensionality reduction likes principle component analysis (PCA). Several practical applications of machine learning tools in solving geoinformatics problems are demonstrated. Students shall have hands-on practicing experiences through various examples and small project assigned.	1. Describe machine learning principles 2. Describe supervised (e.g. SVM) and unsupervised (e.g. SOM) classifications 3. Describe non-linear regression (e.g. LSR) and linear regression (e.g. GD) 4. Describe dimensionality reduction methods (e.g. PCA) 5. Apply unsupervised and supervised classifications to analyze relevant data 6. Apply non-linear and linear regressions to estimate prospective data 7. Apply the machine learning tools to solve given geoinformatics problems

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106816	Artificial Neural Network and Deep Learning for Advanced Geoinformatics Applications	4(4-0-12)	None	This course provides knowledge on artificial neural network with deep learning tools and their applications for geoinformatics issues. Main topics include artificial neural network (ANN), key parameters of neural network's architecture, tuning hyper parameters of neural network, various neural network forms with deep learning, such as Multilayer perceptron (MLP), convolutional neural network (CNN), recursive neural network (RNN), shallow neural network (SNN). Several applications of ANN and deep learning tools in solving geoinformatics problems are demonstrated whereas students shall have hands-on practicing experiences through various examples and small project assigned.	1. Describe concept of artificial neural network with deep learning 2. Describe key parameters in a neural network's architecture 3. Describe concept of hyper parameter tuning of neural network 4. Describe major neural network forms with deep learning like Multilayer perceptron (MLP), Convolutional neural network (CNN), Recursive neural network (RNN), Shallow neural network (SNN), etc. 5. Apply deep learning to build, train and apply to relevant data 6. Apply deep learning to solve specific problem in geoinformatics field

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106817 Cartography and Visualization	4(3-3-10)	None	This course aims to explain and apply cartographic theory for visual communication and visual thinking, as well as for thematic map creation, using GIS software. The content is divided into two main parts: theory and practice. A project-based learning will be employed to enhance important practical skills in mappings of students, such as creating symbolization schemes, coordinate systems and map projections, creating isoline and other terrain data, interpolation, classification schemes, multivariate representation and representation of data uncertainty.	1. Create map that visually communicates two or more variables related to a subject 2. Apply cartographic theory to select visual representations and symbols properly 3. Design effective map layout using visual hierarchy with balance of text and graphic 4. Evaluate appropriate theme for mapping of the given variable types

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106731	Special Topics in Geoinformatics Research	2(2-0-6)	None	This course aims to train students to setup tentative research topic and working plan effectively (for their thesis or independent study). Initial topics include principles of literature review, research topic identification and implementation planning, and effective preparation/ presentation of the progress report. Pragmatic applications of geoinformatics science to fulfil referred study topic/issue are also expected in this course.	1. Explain principles of literature review for proper identification of research topic 2. Explain principles of effective research topic preparation and implementation 3. Explain principles of effective preparation and presentation of progress report 4. Apply geoinformatics science in the study of the given topic/issue effectively

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106732	Geoinformatics for Studies in Atmospheric and Oceanic Sciences	4(4-0-12)	106801 Advanced Remote Sensing or by concent of the school	This course aims to study various aspects of geoinformatics applications to advanced studies in atmospheric and oceanic sciences. These include, in particular, dynamic structure of atmosphere and oceans, important study and research topics in atmospheric and oceanic sciences, principles of atmospheric/oceanic remote sensing, critical changes of atmosphere and oceans and impacts on human and earth, and various applications of geoinformatics in atmospheric and oceanic sciences nowadays.	1. Explain dynamic structure and components of atmosphere and oceans 2. Explain key details of the referred advanced study/research topics in atmospheric and oceanic sciences 3. Explain principles of atmospheric/oceanic remote sensing 4. Analyze critical changes of atmosphere/oceans and impacts on human and earth 5. Apply geoinformatics to the study of the concerned topics/issues in atmospheric and oceanic sciences studies effectively 6. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106733	Geoinformatics for Public Health and Epidemiology Studies	4(4-0-12)	None	This course aims to explore role of geoinformatics in public health and epidemiology studies. Key topics include (1) conceptual framework of public health/epidemiology studies, (2) principle of public health/epidemiology management, (3) public health and epidemiology management modelling, and (4) geoinformatics applications to public health/epidemiology studies. In addition, paper presentation and practical applications of relevant geoinformatics tools and geospatial models for effective public health/epidemiology management shall be implemented also.	1. Explain conceptual framework of public health and epidemiology studies 2. Explain principles of public health and epidemiology management 3. Apply geospatial models to public health and epidemiology studies 4. Integrated yielded knowledge/skills for public health/epidemiology studies practice

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106734	Geoinformatics for Anthropology and Paleoenvironment Studies	4(4-0-12)	106801 Advanced Remote Sensing or by concent of the school	This course explores current applications of geoinformatics science to anthropology (especially archaeology) and paleoenvironment studies in various aspects. These include, in particular, principles of survey location identification, advanced survey tools, principles of land-based survey and airborne/spaceborne survey, spatial data management (e.g. recording, analysis, and processing), creation of complex spatial database, and applications of spatial models to specific works (especially the habitat suitability analysis).	1. Explain important study topics in anthropology and paleoenvironment studies 2. Explain general principles of geoinformatics application to anthropology (especially archaeology) and paleoenvironment studies 3. Analyze advances in current study in anthropology and paleoenvironment studies 4. Apply geoinformatics/spatial models to study of the considered topics/issues in anthropology and paleoenvironment studies effectively 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106735	Geoinformatics for Sustainable Natural Resource and Environmental Management	4(4-0-12)	None	This course aims to provide essential knowledge on sustainable natural resource and environmental management through geoinformatics science as well as relevant practices on this issue. Initial topics include (1) conceptual framework of sustainable natural resource and environmental management, (2) components of natural environment, (3) human influence on environmental changes, (4) principles of sustainable natural resource and environmental management, (5) environmental impact assessment (EIA) process, and (6) natural resource and environmental management modelling.	1. Explain concept of sustainable natural resource and environmental management 2. Explain component of natural environments 3. Explain principle of natural resource and environmental management 4. Apply spatial models to sustainable natural resource /environmental management 5. Integrate yielded knowledge/skills for sustainable natural resource/environmental management in practice

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106736	Geoinformatics for Hydrology and Sustainable Water Resource Management	4(4-0-12)	None	This course provides crucial knowledge on hydrology and sustainable water resource management through geoinformatics science. Initial topics include (1) fundamental principles of hydrology/hydrological process, (2) principles of sustainable water resource management, and (3) sustainable water resource management modelling. In addition, paper presentation and practical uses of appropriate geoinformatics tools and geospatial models for sustainable management of water resource shall be implemented also.	1. Explain fundamental principles of hydrology and hydrological process 2. Explain principles of sustainable water resource management 3. Apply appropriate geospatial models on water resource management 4. Integrated yielded knowledge/skills for water resource management in practice.

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106737	Geoinformatics for Sustainable Management of Terrestrial Ecosystem	4(4-0-12)	None	This course provides crucial knowledge on geoinformatics applications to sustainable management of terrestrial ecosystem. Studied topics include (1) fundamental principles of the terrestrial ecosystem, (2) principles of the sustainable terrestrial ecosystem management, (3) terrestrial ecosystem classification, assessment, and monitoring through remote sensing, and (4) geospatial modelling for sustainable terrestrial ecosystem management. In addition, paper presentation and practical applications of proper geoinformatics tools and geospatial models for sustainable management of terrestrial ecosystem shall be implemented also.	1. Explain fundamental principles of the terrestrial ecosystem 2. Explain principles of sustainable terrestrial ecosystem management 3. Apply geospatial models on sustainable management of terrestrial ecosystem 4. Integrate gained knowledge/skills for terrestrial ecosystem management in practice.

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106738	Geoinformatics for Sustainable Management of Coastal and Marine Ecosystems	4(4-0-12)	None	This course provides crucial knowledge on geoinformatics applications to sustainable management of coastal and marine ecosystems. Initial topics include (1) principles of coastal and marine ecosystems, (2) principle of sustainable coastal/marine ecosystem management, (3) coastal and marine ecosystems classification, assessment, and monitoring through remote sensing, and (4) geospatial modelling for sustainable management of coastal and marine ecosystem. In addition, paper presentation and practical applications of given geoinformatics tools and geospatial models for sustainable management of coastal and marine ecosystem shall be implemented also.	1. Explain principles of coastal and marine ecosystems 2. Explain principles of sustainable coastal and marine ecosystems management 3. Apply geospatial model to sustainable management of coastal/marine ecosystems 4. Integrate yielded knowledge/skills for sustainable management of coastal/marine ecosystems in practice.

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106739	Geoinformatics for Integrated Watershed Management of Land and Resources	4(4-0-12)	None	This course provides crucial knowledge on geoinformatics applications to integrated watershed-scale management of land and resources. Studied topics include (1) principles of watershed management, (2) geomorphology of watershed, (3) soil erosion, landslide, flood and drought, (4) integrated watershed management of land and resources, and (5) land use change models for land and resources management. In addition, paper presentation and practical applications of proper geoinformatics tools and geospatial models for integrated watershed management of land and resources shall be implemented also.	1. Explain principles of integrated watershed management of land and resources 2. Explain about geomorphology of watershed, soil erosion, landslide, flood, drought 3. Apply geospatial models to integrated watershed management of land/resources. 4. Integrate yielded knowledge/skills for integrated watershed-scale management of land and resources in practice.

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106741	Geoinformatics for Effective Disasters and Risk Management	4(4-0-12)	106801 Advanced Remote Sensing or by concent of the school	This course aims to study applications of geoinformatics science to the management of disasters and risk effectively, especially natural disasters. These disasters are classified by their types and origins, e.g., man-made disasters, geological disasters, hydrological disasters, meteorological disasters, environmental disasters, space disasters, as well as the prominent natural disasters in ASEAN countries.	1. Explain origins, characteristics, and impacts of the given disasters 2. Explain origins, characteristics of prominent natural disasters in ASEAN countries 3. Explain principles of geoinformatics/spatial model applications to the management of given disasters, or risk, effectively 4. Apply geoinformatics science/spatial models to the study of given topics/issues in disasters and risk management effectively 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments
106742	Geoinformatics for Sustainable Energy Management	4(4-0-12)	106803 Advanced Geographic Information System or by consent of the school	This course aims to explain about sustainable management of energy in both cases of the renewable and non-renewable energy, as well as tendencies of energy consumption and future situation. The student is required to present a project showing the application of geoinformatics technology to the relevant energy issues for sustainable management.	1. Explain definitions of energy and sustainable energy management 2. Discuss on direction/tendency of energy consumption in the future 3. Analyze factors considered in sustainable energy management using GIS 4. Present a project of interest in sustainable energy management

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106743	Geoinformatics for Land Resource Management and Suitability Analysis	4(4-0-12)	None	This course provides key knowledge on geoinformatics applications to land resource management and suitability analysis. Initial topics includes (1) fundamental principles of land resource management, (2) modelling of suitable land allocation, (3) principles and procedure of land evaluation, (4) land suitability analysis and land use planning, and (5) soil quality assessment for plantation of economic crops. In addition, paper presentation and practical applications of appropriate geoinformatics tools and geospatial models for land resource management and suitability analysis shall be implemented also.	1. Explain principle of land resource management and suitability analysis 2. Explain suitable land allocation models 3. Explain principles and procedure of land evaluation 4. Apply land allocation model to land suitability analysis and land use planning

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106744 Geoinformatics for Advanced Agricultural Sector Management	4(4-0-12)	None	This course aims to study geoinformatics applications to advanced agricultural sector. Notable topics are precision farming and smart farming. Main contents are principles of the analysis of vegetation indices, that represent conditions of remotely-sensed vegetation, and other geoinformatics applications, which are necessary for the effective implementations of the precision and smart farming.	1. Explain definitions/concepts of advanced, precision, and smart farming systems 2. Discuss tendency of geoinformatics applications to advanced, precision, and smart farming systems 3. Analyze indices representing conditions of vegetation using remote sensing data 4. Analyze vegetation conditions and planting locations using geoinformatics methods for effective management of agricultural sector

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106745 Geoinformatics for Planning and Management of Smart City	4(4-0-12)	None	This course aims to explain essential theories of smart city management. Main topics include urban components, evolution of urbanization, tools to forecast the urban expansion, land use planning regarding limitation of relevant laws. Implementation of GIS-based models in assessing suitability of the city management based on known internal/external influencing factors is also provided through the simulation and prediction of the models in use.	1. Explain theories of smart city as well as give examples of smart city at present 2. Discuss urban theories, evolution of urbanization and various types of city planning 3. Assess the sufficient provisional infrastructure and traffic connecting to the urban expansion with optional solutions 4. Evaluate the environmental impacts on urbanization with solution guideline 5. Present feasible analysis project in transportation, socio-economics, environmental situation for smart city management in response to internal/external resources practically 6. Predict urban expansion using appropriate urban growth models

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106746 Geoinformatics for Pollution and Urban Environment Management	4(4-0-12)	None	This course aims to study various kinds of pollution in urban environment regarding enforced standards and regulations. One of many topics leads to a discussion regarding the barriers to data collection which may affect to reliability of analyzed results. Development and tendency of the achievements in mitigating urban pollution around the world shall be discussed intensively. This course contains a demonstration showing some techniques used to analyze vulnerable areas and endangered areas prone to urban pollution. The final part includes discussion on the intelligent warning system of the current situation in urban areas.	1. Identify the pollution situations regarding the standards and the cycle in pollution occurrences in urban areas accurately 2. Present the guidelines to control pollution situations and prevention of the re-occurrences in Thailand and other countries 3. Apply Geoinformatics technology to solve and manage urban pollutions properly 4. Analyze and present the vulnerable areas, endangered areas regarding the urban pollutions accurately 5. Planning monitoring system regarding the potential factors used in geoinformatics technology 6. Discuss and present a guideline of an intelligent monitoring system response to current pollution situations in urban areas effectively

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106747	Geoinformatics for smart transportation and traffic system management	4(4-0-12)	106803 Advanced Geographic Information System or by consent of the school	This course covers the fundamental theorem of network analysis in GIS, transportation model and traffic management system. It also presents insight image of main components and architecture of data infrastructure in the smart traffic system. This basic infrastructure is considered in database design for traffic management system effectively. Some projects will be intensively studied and analyzed in network analysis corresponding with the intelligent traffic management system.	1. Understand the fundamental theorem of the functions of network analysis in GIS 2. Explain the constructive models of transportation and traffic management system 3. Design database of tourism and traffic response to components and architectural infrastructure of smart traffic management system 4. Analyze the network analysis techniques to overcome the taken issues accurately 5. Present the analyzed results rationally through network analysis for transportation and traffic management clearly

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106748	Geoinformatics for Effective Management of Business and Public Services	4(4-0-12)	None	This course aims to study applications of geoinformatics science to the management of business and public services effectively. Focus is on location-based businesses, e.g., retail, insurance, real estate. Public services are considered based primarily on level of their service area (e.g., local, city, regional, national) and their organizations (both public/private sectors).	1. Explain principles of effective management in location-based business and service 2. Explain principles of geoinformatics applications to the management of considered location-based business and service effectively 3. Apply geoinformatics/spatial models to the study of the considered topics/issues in business and public services management effectively 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106749	Geoinformatics for Sustainable Tourism and Recreational Management	4(4-0-12)	106803 Advanced Geographic Information System or by consent of the school	This course aims to implement geoinformatics technology to sustainable tourism and recreational management with response to sustainable concerns (regarding social, economic, and environmental issues). Apart from the fundamental theory, this course also focuses on tourism database creation and its management as well as thematic mapping. Discussions on current situations of tourism and recreational management by implementing geoinformatics technology in all relevant aspects are also emphasized.	1. Explain meaning/concept of tourism management according to the tourism places 2. Discuss optimal balance in social, economic, and environment for sustainability concept of tourism and recreational management 3. Produce a thematic map of tourism and recreation accurately 4. Analyze and present the application of geoinformatics technology for sustainable tourism and recreational management

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106751	Geoinformatics for Military and Law Enforcement Affairs Management	4(4-0-12)	None	This course aims to study applications of geoinformatics science to the management of military and law enforcement affairs effectively. For military affairs, focus is placed upon some important tasks, e.g., mapping, strategic database creation, terrain analysis, monitoring of target activities/areas, operation planning. And for the law enforcement affairs, focus is on improving capability of concerned state organizations by proper geoinformatics applications, e.g., police department, DSI, or Department of Justice.	1. Explain concepts and advances in geoinformatics applications to the management of military and law enforcement affairs effectively by the named organizations 2. Apply geoinformatics science to the study of referred topics/issues in military and law enforcement affairs management effectively 3. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106752	Geoinformatics for Effective Management of Strategic Public Affairs	4(4-0-12)	None	This course aims to study effective managements of strategic public affairs through proper applications of geoinformatics. Several enforced strategic public policies or plans are considered, e.g., Thailand 4.0, 20-year national strategic plan (2017-2036), as well as specific plans for some critical issues like the water resource management plan, and current strategic plans implemented by several state organizations at provincial to national level.	1. Explain main content of the given strategic policies/plans of the government/state organizations 2. Explain principles of geoinformatics applications to the management of strategic public policies/plans of the government/state organizations effectively 3. Apply geoinformatics science to the study of given topics/issues in strategic public affairs management effectively 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments
106753	Geoinformatics for Effective Provincial and Local Administrations	4(4-0-12)	None	This course aims to study applications of geoinformatics science to the administration at provincial and local levels effectively based on plans/policies enforced at provincial level, or on missions under responsibility of the state agencies at provincial or local levels.	1. Explain main content of the given policies/plans at provincial level 2. Explain principles of geoinformatics application to aid effective provincial and local administrations 3. Apply geoinformatics science to the study of concerned topics/issues in provincial and local administrations effectively 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106754	Geoinformatics for Integrated ASEAN Development and Management	4(4-0-12)	None	This course aims to explore applications of geoinformatics science to the integrated management/development of ASEAN region in various aspects. These include, in particular, environment/natural resources, city and its environment, quality of life/economic security, climate change, natural disasters/severe pollutions, and public health/epidemiology.	1. Explain structure of ASEAN region and its management issues 2. Explain principles of geoinformatics applications to the management/development of ASEAN effectively on the given topics 3. Apply geoinformatics science to the study of concerned topics/issues in integrated management /development of ASEAN region effectively 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments
106831	Geoinformatics for Geology and Civil Engineering Studies	4(4-0-12)	106801 Advanced Remote Sensing or by consent of the school	This course aims to study applications of geoinformatics science in geology and civil engineering studies on various topics. These include, in particular, field survey, observation of target areas using airborne/spaceborne remote sensing tools (both active/passive types), 2D/3D mapping, construction of complex spatial database, analysis/processing of spatial data under given criteria, and applications of spatial models in specific tasks (especially for safety and risk analysis).	1. Explain principles of geoinformatics application to geology/civil engineering studies 2. Apply geoinformatics tools to the survey/collection of spatial data effectively 3. Apply geoinformatics science to the study of concerned topics/issues in geology and civil engineering studies effectively 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106832	Geoinformatics for Advanced Meteorology and Climatology Studies	4(4-0-12)	106801 Advanced Remote Sensing or by consent of the school	This course aims to study applications of geoinformatics science to advanced studies in meteorology and climatology. Main topics include origin and patterns of climate variation (in both spatial/temporal aspects) at local to global scales, impacts of climate changes (from past to present) on human and earth, progress on various fields (especially geoinformatics) in the monitoring and prediction of weather at present.	1. Explain crucial topics/issues in meteorology/climatology studies at present 2. Explain origins and patterns of climate variation (in both spatial/temporal aspects) 3. Analyze impacts of climate changes (from past to present) on human and earth 4. Analyze important roles of weather monitoring and prediction at present 5. Apply geoinformatics science to the study of concerned topics/issues in advanced meteorology and climatology studies effectively 6. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106888 Geoinformatics for Social Science Studies and Applications	4(4-0-12)	None	This course aims to explore roles of geoinformatics science in effective social science studies and applications. Prominent fields of social science to be considered are geography, anthropology, criminology, law, economics, economic development, education, sociology, for instance.	1. Explain notable topics in social science studies and applications nowadays 2. Explain principles of geoinformatics applications to the referred social science task 3. Analyze case studies of geoinformatics application to interested social science task 4. Apply geoinformatics science to the study of given topics/issues in advanced social science studies effectively 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106561	Introduction to Geoinformatics	4(3-3-10)	None	The course provides essential knowledge on geoinformatics science and technology including remote sensing (RS), geographic information system (GIS), and global positioning system (GPS). Described topics also include data acquisition, encoding, enhancement, and management. In addition the process of data interpretation, analysis, and input to make GIS data layers shall be discussed and practiced in laboratory and examples of their applications are given. Hands-on work on geo-information using software is demonstrated in laboratory.	1. Describe working principles of the given remote sensing systems 2. Describe working principles of the geographic information system (GIS) 3. Describe working principles of the global positioning system (GPS) 4. Apply geoinformatics technology to solve various problems

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106562 Introduction to Meteorology	3(3-0-6)	None	This course aims to offer fundamental knowledge of meteorology in various aspects to students. These include, in particular, meteorological elements (e.g. air temperature, air humidity, air pressure), optical phenomena, clouds, rain, storms, air movement (at local to global scales), climate changes (from past to present) and their impacts, air pollutions and disasters, scientific progress in weather monitoring and prediction (especially those related to geoinformatics science) at present.	1. Explain characteristics and variation pattern of meteorological elements of interest 2. Explain formation process and characteristics of the optical phenomena of interest 3. Analyze trend of climate changes (spatial/temporal aspects) and their impacts on human and earth 4. Analyze roles of geoinformatics in atmosphere observations/weather prediction 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106563 Earth Science: Theory and Applications	3(3-0-6)	None	This course aims to provide fundamental theories and applications of earth science in various topics. These include, in particular, origins and development of earth and living organisms based on theories and empirical evidences, dynamic structure and components of earth system (lithosphere, hydrosphere, atmosphere, biosphere), relationship of humans and nature, advances and significant roles of earth science, and roles of geoinformatics science in earth science study nowadays.	1. Explain origins and development of earth and living organisms based on theories and empirical evidences 2. Explain dynamic structure and components of earth system 3. Explain relationship of humans and nature, 4. Analyze notable advances and significant roles of earth science 5. Analyze roles of geoinformatics science in earth science study nowadays 6. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106564	Space Technology: Development and Applications	3(3-0-6)	None	This course aims to study space technology science in various topics. These include, in particular, origin and development; roles of the leading space organizations of the world (especially NASA); travelling between earth and space; travelling in space; working principles of satellite, spacecraft, and spaceborne remote sensors; life in space; spaceborne remote sensing of earth, solar system, and universe; prominent earth and space exploration projects; and roles/advances in space technology nowadays	1. Explain origin/development of space technology and roles of key space agencies 2. Explain principles of travelling between earth and space and travelling in space 3. Explain working principles of satellite, spacecraft, and spaceborne remote sensors 4. Explain concept of life in space and how to live in space productively 5. Analyze advances in earth/space exploration by space technology 6. Analyze advances in space technology and its roles in the modern world 7. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106565	Human Geography: From Past to Present	3(3-0-6)	None	This course aims to provide knowledge of human geography in various topics. These include, in particular, human origins, evolution, and their settlements (from past to present), diversity of human characteristics (e.g. believe, culture, politics, way of life), births of the city and civilization, pattern of life at present time, and applications of geoinformatics science to the human geography study nowadays.	1. Explain origins, evolution, and settlement pattern of humans from past to present 2. Explain diversity in notable human characteristics and their relevant causes 3. Analyze variation in human's pattern of life from past to present 4. Analyze roles of geoinformatics science to the human geography study nowadays 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments
106661	Advanced Geographical Tools	3(3-0-6)	None	This course aims to explore prominent geographical tools and their applications to various tasks (including geography education). These tools are initially divided into groups including (1) 2D maps, (2) field surveys, (3) statistical data analysis, (4) spatial technologies (e.g. virtual map, satellite imagery, aerial photo, GPS receivers, UAV-based photogrammetry, GIS, remote sensing), (5) data/information presentation technology, (6) new media/internet technologies for works in geography.	1. Explain about crucial advanced geographical tools and applications in various tasks 2. Apply the advanced geographical tools to effective study of the given topics/issues 3. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106662	Advances in Applied Geoinformatics	3(3-0-6)	None	This course aims to study advances in applied geoinformatics on several fields. First, working principles of main geoinformatics science components (remote sensing, GIS, GNSS) are presented followed by apparent advances in geoinformatics applications to various fields of interest. These include, in particular, agriculture and rural development, hydrology/water resource management, ecosystem management, city and urban environment management, environment/severe pollution management, disaster/risk management.	1. Explain working principles of main components of geoinformatics (RS, GIS, GNSS) 2. Explain principles of geoinformatics applications to the referred field of interest 3. Analyze advances in applications of geoinformatics science to the given fields 4. Apply the geoinformatics science to effective study of the concerned topics/issues in applied geoinformatics 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106663	Laws for Natural Resource and Environmental Management	3(3-0-6)	None	This course aims to study general concepts of environmental and natural resources management through established laws in various aspects, for examples, natural resources management, conservation of nature and pristine environment, forest/wildlife management, environmental/health impact assessments (EIA/HIA) and international law/agreement in this field. Applications of geoinformatics science to effective enforcement of these laws are also presented and discussed herein.	1. Explain concepts of environmental/natural resources management through laws 2. Explain crucial laws for given environmental/natural resources management issues 3. Analyze roles of geoinformatics applications in effective enforcement of concerned laws in environmental and natural resources management 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106761	Physical Principles of Remote Sensing	(3-0-6)	None	This course aims to provide knowledge on physical principles of remote sensing and its associated applications in various situations. Principle topics include electromagnetic (EM) theories and principles of remote sensing through electromagnetic waves, working principles of standard remote sensors at different spectral wavebands (especially visible, infrared, and microwave portions), and principles of remote observation in dynamics of earth's four main components (land, ocean, atmosphere, and biosphere).	1. Explain electromagnetic theories/principles of remote sensing through EM waves 2. Explain working principles of remote sensors at different spectral wavebands 3. Explain principles of remote sensing in dynamics of earth's 4 core components 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106762	Geoinformatics for Sustainable Development of the Country	3(3-0-6)	None	This course aims to study geoinformatics applications to sustainable development of the country in various aspects. These include, in particular, natural resources/environmental management, urban planning and city management, Agricultural and industrial management, crucial security managements (e.g. food, energy, economy) and quality of life development. Content also covers development of policies by responsible state agencies, or organizations, to fulfil these aforementioned needs (Intelligent Action Policy).	1. Explain concepts and theories in sustainable development of the country 2. Explain principles of geoinformatics applications to the sustainable development of the country in given fields 3. Analyze state policies established to aid sustainable development of the country 4. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106763	Sustainable Management of Human-Environment Relationship	3(3-0-6)	None	This course studies sustainable management of human-environment relationship in various aspects. These include, in particular, related theories, sustainable managements seen in various sectors (e.g. agricultural/local parts, city/industrial parts) and community scales (from local to global scales), relevant social mechanisms/laws on this issue, and applications of geoinformatics science to fulfill such management.	1. Explain theories on sustainable management of human-environment relationship 2. Explain management principles on such issue in given sector or community scale 3. Analyze effectiveness of applied social mechanisms/laws in some case studies 4. Apply the geoinformatics science to effective study of the concerned topics/issues in sustainable management of human-environment relationship 5. Integrate relevant knowledge/skills to fulfill needs stated in the given assignments

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106764	English Proficiency for Geoinformatics Study and Research	3(3-0-6)	None	Development of English proficiency in 4 essential skills: listening, reading, speaking, and writing, improvement of listening skill using media on the internet holding content of geoinformatics software and data analysis methods, improve of reading skill by textbook and research article reading, development of speaking skill by delivering a presentation on the conclusion drawn from the reading and leading a discussion on the questionable issues, organizing knowledge gained from the reading and discussion and then writing report to enhance writing skill	1. Explain new knowledge gained via listening the internet media 2. Summarize main idea from the reading 3. Present the main idea from the reading to the class 4. Discuss the questionable issues from the reading 5. Organize knowledge gained from the reading and discussion
106765	Graduate Cooperative Education in Geoinformatics	8(0-0-0)	Pre-cooperative Education course, or by concent of the school	This course aims to offer students work-based experience in the qualified workplace which lasts for about 1 semester (4 months).	1. Explain roles of geoinformatics in cooperative education at preferred workplace 2. Apply knowledge/skills in geoinformatics for cooperative education effectively

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
205501	Entrepreneurship and Innovation	2(2-0-4)	None	Study of entrepreneurship, innovation and technology business, open innovation, attitudes and motivation of innovative entrepreneurs and social entrepreneurs, characteristics of successful entrepreneurs, new venture process, business model generation and business plan, business Frost & Sullivan feasibility and problems of new ventures.	
205502	Opportunity and Feasibility Analysis	2(2-0-4)	None	Identify potential opportunities, trend and market analysis, technology roadmap and forecasting, opportunity assessment, develop a business concept and vision, customer's insight and customer validation, and feasibility analysis.	
205503	Intellectual Property Strategies	2(2-0-4)	None	Concepts and principles of intellectual property management, intellectual property from research and development, patent searching, intellectual property laws and methods of intellectual property protection, intellectual property valuation and method in creating return on intellectual properties.	

Courses		Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
205507	Entrepreneurial Marketing	3(3-0-6)	None	Marketing for new products and new markets, market opportunity analysis and evaluation, market segmentation strategies, value proposition design, marketing strategies and marketing plan, the use of internet in marketing, new product launch, branding and brand management, and marketing metrics.	
205508	Entrepreneurial Finance	3(3-0-6)	None	Principles of entrepreneurship, financing for entrepreneurial processes from start-up to harvesting, cost structure and financing need analysis, revenue model analysis, financing from money and capital markets, analysis and evaluation of financing sources, and cash flow analysis.	
Seminar Course					
106881	Seminar I (for Ph.D. Program)	1(1-0-3)	None	To present problems or academic interests in specific geoinformatics research topics at Ph.D level that might eventually lead to the formation of thesis proposal.	
106882	Seminar II (for Ph.D. Program)	1(1-0-3)	None	To present final progress of the thesis work by Ph.D. students.	
Thesis Course					

Courses	Credit (Lect.-Lab-Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
106891 Ph.D. Thesis (Scheme 1.1)	60	None	Original research leading to the formation of a thesis as required by the University's Regulations for the Doctoral degree scheme 1.1.	
106892 Ph.D. Thesis (Scheme 2.1)	45	None	Original research leading to the formation of a thesis as required by the University's Regulations for the Doctoral degree scheme 2.1.	
106893 106893 Ph.D. Thesis (Scheme 2.2)	60	None	Original research leading to the formation of a thesis as required by the University's Regulations for the Doctoral degree scheme 2.2.	