6.1 ABOUT THE DEPARTMENT

The Department of Geodetic Engineering offered its first degree program in 1937. With the establishment of the Training Center for Applied Geodesy and Photogrammetry (TCAGP) on October 7, 1964, the Department expanded its role to research, extension and training. The Training Center develops national capacity by offering training and technical services to professional and technical personnel in various government agencies.

In the early 1990's, the Department started offering graduate programs in Remote Sensing and Geographic Information Systems (GIS) through the RP-Australia Remote Sensing Project. As part of the project, the Remote Sensing Image Analysis Laboratory (RSIAL) was inaugurated on January 13, 1993 for resource management and environmental planning. Through a grant from the Environmental Systems Research Institute (ESRI), the GIS Laboratory was formally inaugurated in 2003.

At present, the Department actively maintains three instructional laboratories: the Remote Sensing Image Analysis Laboratory, the GIS Laboratory and the Digital Photogrammetry Laboratory. All three laboratories currently house computers and software to cater to the needs of undergraduate students in their various B.S. GE subjects. For the students' fieldwork needs, various surveying instruments such as global positioning systems (GPS) receivers, total stations, digital and automatic levels are available in the instrument room. As part of the ongoing thrust of the Department in enhancing its research capabilities, the Applied Geodesy and Space Technology (AGST) Research Laboratory was inaugurated on November 8, 2005. AGST provides an environment for undergraduate and graduate students to undertake their research work. Among the equipment available in this laboratory includes a terrestrial laser scanner, an imaging station, a shallow water multibeam echo-sounder and other sophisticated geodetic and hydrographic surveying instruments.

Among 36 schools that offer the B.S. Geodetic Engineering program, the Department was chosen by the Commission on Higher Education (CHED) to be the country's CENTER OF EXCELLENCE in Geodetic Engineering in 2001. This is in recognition of its academic achievements and excellence in training and educating future geodetic engineers. The Department is also proud of its consistent record in the percentage of passers in the professional GE Board examinations and maintains a tradition of producing topnotchers. Time and again, the Professional Regulation Commission (PRC), through the Board of Geodetic Engineering, acknowledges the Department's exemplary performance in these examinations.

Currently, there are two Geodetic Engineering student organizations – the Geodetic Engineering Club (GEC), established on August 15, 1937, and the Society of Geodetic Engineering Majors (Geop), established on June 11, 2001.

6.2 VISION

A nationally relevant and internationally recognized academic institution of empowered and competent faculty and staff, globally competitive graduates, with state-of-the-art facilities that will further the causes of academic excellence, leadership and service to the country.

6.3 MISSION

Bring out the best in our students and together develop new ways by which science and technology of earth and space observation and measurement can be strengthened to make it work for the good of the nation.

6.4 UNDERGRADUATE PROGRAM

The 5-year Bachelor of Science in Geodetic Engineering (B.S.GE) program offers a comprehensive and relevant curriculum highlighting advanced science and technologies in the fields of surveying, mapping and cartography, geodesy, and geomatics.

Traditionally, Geodetic Engineering focuses on the determination, recording and setting out of boundaries, as Geodesy is based on registration and surveying of exact positions of points on vast areas of the earth. These are carefully done through measurements based on the earth's gravity field.

Recent developments in the domain of satellite techniques have greatly increased the possibilities of earth-oriented space research and measurements. The introduction of global navigation satellite systems (GNSS) brought new methods for the determination of reference points aside from direct field measurements.

Geomatics is the modern term referring to the science, engineering, and art involved in collecting and managing geographically referenced information. It integrates all the means used to acquire and manage spatial data as part of scientific, administrative, legal and technical operations involved in the process of production and management of Earth-based data. It includes disciplines such as: Surveying, Geodesy, Remote Sensing, Photogrammetry, Cartography, Geographic Information Systems, and Global Positioning Systems.

6.4.1 Program Educational Objectives

The UP Department of Geodetic Engineering nurtures its students to become leaders, innovators, system integrators, knowledge generators, and solution

providers in their chosen fields of Geodetic Engineering, applying their knowledge and skills in addressing the country's geoinformation needs, thereby contributing to capacity-building of local communities while demonstrating a keen understanding and interest in national, regional and global developments. Specifically, the Geodetic Engineering program educates and prepares graduates to:

1. Apply engineering fundamentals to solving issues and concerns of communities towards local and national development. This entails participation in public and private undertakings to provide geospatial data and information and serve as managers and leaders in engineering and non-engineering endeavors in the public and private sectors;

2. Continue personal and professional development towards lifelong learning and a lifetime of careers;

3. Engage in activities contributing to the development of the profession and enhancement of practice through active participation in professional organizations and developmental organizations.

6.4.2 Program Outcomes

By the time of graduation, the students of the program shall be able to:

1. Apply knowledge of mathematics, physical sciences, engineering sciences and technologies in the practice of geodetic engineering;

2. Design and conduct experiments to test hypotheses and verify assumptions, as well as to organize, analyze and interpret data, draw valid conclusions, and develop mathematical models for various processes;

3. Design, improve, innovate, and supervise systems or procedures within realistic constraints to serve the needs of government, industry, and community organizations;

4. Work effectively in multi-disciplinary and multi-cultural settings in diverse fields of practice;

5. Identify, formulate, and solve geodetic and related engineering problems;

6. Understand the relevance of the geodetic engineering profession to the environment and the society, as well as the social and ethical responsibilities of the profession;

7. Possess specialized knowledge and skills in at least one focus area of geodetic engineering practice and apply such knowledge to provide solutions to actual problems;

8. Demonstrate effective oral and written communications in both Filipino and English;

9. Engage in life-long learning and keep current on the developments in the profession;

10. Use the appropriate techniques, skills, and tools necessary in the practice of geodetic engineering;

11. Gain knowledge on contemporary issues and suggest corresponding improvements for the program;

12. Serve the Filipino people through committed, competent, and caring practice of the profession with advocacy and volunteerism.

6.5 GRADUATE PROGRAM

Geomatics Engineering deals with the theoretical and technical principles that need to be understood in the expert application of the sciences and technologies involved in acquiring, processing, integrating, and portraying geographically referenced information. The Master of Science program in Geomatics Engineering encompasses the two masters programs in Remote Sensing and Geodetic Engineering. With such a wide scope, three (3) fields of specialization has been offered in pursuing the M.S. Geomatics Engineering degree in order to focus the students' expertise and effort in doing their graduate research thesis. These specializations are as follows:

- M.S. Geomatics Engineering
  (Field of Specialization: Remote Sensing and Photogrammetry)

- M.S. Geomatics Engineering
  (Field of Specialization: Applied Geodesy)

- M.S. Geomatics Engineering
  (Field of Specialization: Geoinformatics)

M.S. Geomatics Engineering
Field of Specialization: Remote Sensing and Photogrammetry

Remote Sensing is concerned with acquisition of information about an object or phenomenon, by the use of either recording or real-time sensing device(s) that is not in physical contact with the object (such as by way of aircraft, satellite, or ship). It deals with acquiring data commonly in the form of images, which are subsequently digitally processed to extract desired information about the environment. In practice, remote

sensing is the stand-off collection through the use of a variety of devices for gathering information on a given object or area. The use and application of remote sensing techniques has become pervasive in disciplines such as cartography, urban and regional planning, forestry, aquatic sciences, geology, meteorology and many others. It deals with the basic need of acquiring information about objects, phenomena and processes on and in the earth, such as the physical environment, natural and man-made resources in order to understand their uses and critical changes. It draws from many disciplines, including computer science, engineering, environmental sciences, mathematics, and statistics in order to understand how data are remotely captured, represented and later processed to obtain information. Information derived through remote sensing techniques are critical inputs to further spatial analysis and modeling.

The M.S. Geomatics Engineering (Field of Specialization: Remote Sensing and Photogrammetry) is specially intended for those who will be involved in the design and development of remote sensing techniques and approaches in order to provide vital information in support of decision-making about the environment. They are people whose organizations are concerned with the generation of primary spatial data through analysis of images and other remotely sensed data. Upon completing the degree, their skills in doing research and development in the field of remote sensing will be improved. Specifically, these include:

- Understanding of the underlying principles in acquiring, processing, transmitting, storing, representing, and using remotely sense data;
- Competence in designing of remote sensing techniques in order to provide an efficient method for obtaining primary spatial data;
- Capability in designing and carrying out research and development projects in various aspects of remote sensing;
- Confidence in communicating and transferring knowledge on remote sensing to others

M.S. Geomatics Engineering
Field of Specialization: Applied Geodesy

Geodesy or geodetic surveying is the theory and practice of determining the position of points on the earth's surface and the dimensions of large areas so that the curvature of the earth must be taken into account. It is distinguished from plane surveying, the operations of which are executed without regard to the earth's curvature. Geodesy uses spaceborne and airborne remotely sensed, and ground-based measurements to study the shape and size of the Earth, and their changes; to precisely determine position and velocity of points or objects at the surface or orbiting the planet, and to apply these knowledge to a variety of scientific and engineering applications, using mathematics, physics, astronomy, and computer science. In recent years, Geodesy has undergone technological and theoretical changes with the advent of artificial earth satellites and satellite-based global positioning systems that have come into wide use as geodetic instruments. The accuracy of satellite geodetic data has improved to sub-centimeter levels. This bodes well with the application of geodetic data to the solution of problems in solid earth, oceanic and atmospheric sciences.

The M.S. Geomatics Engineering (Field of Specialization: Applied Geodesy) is specially intended for those who will be involved in determining and registering the exact geographic positions, in studying processes and changes of areas and points on the earth's surface. They are people whose organizations are concerned with the production and use of precision referencing and map making, large infrastructure designs, environmental science, and geosciences. Upon completing the degree requirements, their skills in doing research and development in the field of geodesy and associated disciplines will be improved. Specifically, these include:

- Understanding of the underlying principles in accurately determining the positions of points on the earth's surface through satellite-based positioning systems and ground-based techniques;
- Competence in designing survey methods and approaches in order to provide an efficient method for establishing geodetic control systems;
- Capability in designing and carrying out research and development projects in various aspects of geodesy;
- Confidence in communicating and transferring knowledge about geodesy to others

M.S. Geomatics Engineering
Field of Specialization: Geoinformatics

Geomatics is also concerned with the theories of structuring, storing, analyzing, and managing spatial data, and aims at the development and application of methods for solving specific problems in geosciences (geodesy, geography, geology, geophysics and others). It deals with information about objects, phenomena and processes on and in the earth, such as the physical environment, natural and man-made resources, their uses and changes. Computer systems are now being used pervasively for this purpose. As such, **Geoinformatics** is focused on developments that allow the representation of spatial information or geoinformation using computer models. It uses

computer-based geographical information technology and computer cartography for the analysis and presentation of complex spatial data. It draws from many disciplines, including computer science, engineering, environmental sciences, social sciences, business, planning, mathematics, and statistics in order to understand the different ways geographic space is perceived and represented, and thereby critically and effectively carry out spatial modeling, spatial analysis, and visualization of the common space to be managed.

The M.S. Geomatics Engineering (Field of Specialization: Geoinformatics) is specially intended for those who will be involved in the design and development of geographic information systems (GIS) to support decision-making about the environment. They are people whose organizations are concerned with the collection and use of geoinformation. Upon completing the degree, their skills in doing research and development in the field of geoinformation handling will be improved. Specifically, these include:

- Understanding of the underlying principles in collecting, processing, managing, representing, and disseminating geoinformation;
- Competence in designing of geoinformation systems in order to provide an efficient method for archiving, accessing, and analyzing geoinformation;
- Capability in designing and carrying out research and development projects in various aspects of geoinformation;
- Confidence in communicating and transferring geoinformatics knowledge to others

Admission Requirements

In order to be admitted to the M.S. Geomatics Engineering program, the applicant must have obtained at least a B.S. degree in Engineering or allied fields from a reputable institution of higher learning and achieved an above-average scholastic performance. Application requirements include transcript of records, copy of diploma, duly accomplished application forms, recommendations from three former professors or supervisors, and payment of application fees. The pre-screened applicant should pass a final interview to be conducted by the Department Graduate Program Committee (DGPC) prior to acceptance.

6.6 FACILITIES

Instructional Laboratories

- Remote Sensing Image Analysis Laboratory (RS Lab)
- ESRI GIS Center (GIS Lab)
- Digital Photogrammetry Laboratory (DP Lab)

Research Laboratories

- Applied Geodesy and Space Technology Research Laboratory (AGST Lab)
- Environmental Systems Applications of Geomatics Engineering Research Laboratory (EnviSAGE Lab)
- Geographic Simulation Research Laboratory (GeoSIM)
- Surveying, Land Administration and Valuation Research Laboratory (SURVLAV)

6.7 FACULTY AND STAFF

The Department is proud of its immensely talented faculty with varying fields of expertise, which have brought the learning process diversity in perspective, but with synergy in approach. The following are the hardworking and dedicated men and women of the GE Department:

Department Chair

Dr. Ariel C. Blanco

Professors

Rhodora M. Gonzales
Ph.D. Applied Geographic Information Systems
ITC-Wageningen University, 2000
GIS, Remote Sensing

Enrico C. Paringit
D. Eng. Civil Engineering
Tokyo Institute of Technology, 2003
Remote Sensing, Environmental Spectroscopy, Geodesy

Associate Professor

Ariel C. Blanco
D. Eng. Environmental Informatics
Tokyo Institute of Technology, 2009
Environmental Informatics, RS and GIS for Environmental applications, Photogrammetry

Assistant Professors

Rosalie Bandojo-Reyes
D. Eng. Remote Sensing and GIS
Asian Institute of Technology, 2014
Geodesy

DEPARTMENT OF GEODETIC ENGINEERING

Ma. Rosario Concepcion O. Ang
M.S. Remote Sensing
University of the Philippines Diliman, 2011
Remote Sensing, GIS and Photogrammetry

Louie P. Balicanta
M.A. Urban and Regional Planning
University of the Philippines Diliman, 2010
Urban Planning and Land Administration, Geodesy

Anjillyn Mae J. Cruz
M.S. Remote Sensing
University of the Philippines Diliman, 2013
Environmental RS and GIS, Surveying

Florence A. Galeon
M.S. Remote Sensing
University of New South Wales, 1994
Remote Sensing, Surveying, Mapping, Land Valuation

Oliver T. Macapinlac
M.S. Remote Sensing
University of the Philippines Diliman, 2008
GIS, Multi-Agents Simulation

Jeark A. Principe
M.S. Remote Sensing
University of the Philippines Diliman, 2013
Remote Sensing, GIS, Hydrological Modeling, Surveying

Czar Jakiri S. Sarmiento
M.S. Remote Sensing
University of the Philippines Diliman, 2010
Remote Sensing, GIS, Hydrology

Ayin M. Tamondong
M.S. Remote Sensing
University of the Philippines Diliman, 2013
Remote Sensing, GIS

Mark Edwin A. Tupas
M.S. Remote Sensing
University of the Philippines Diliman, 2012
Remote Sensing, GIS, Programming

Instructors

Bienvenido G. Carcellar
B.S. Geodetic Engineering
University of the Philippines Diliman, 2015

Alexis Richard C. Claridades
M.S. Geomatics Engineering
University of the Philippines Diliman (in progress)

Trishia C. Guevara
M.S. Urban and Regional Planning
University of the Philippines Diliman (in progress)

Edgardo G. Macatulad
M.S. Geomatics Engineering
University of the Philippines Diliman (in progress)

Roseanne V. Ramos
M.S. Geomatics Engineering
University of the Philippines Diliman (in progress)

Lecturers

Atty. Quirino P. Clemeno, Jr.
Bachelor of Laws
University of Batangas, 1997

Engr. John Louie D. Fabila
B.S. Geodetic Engineering
University of the Philippines Diliman, 2004

Engr. Rowane May A. Fesalbon
M.S. Geomatics Engineering
University of the Philippines Diliman (in progress)

Atty. Brenda Jay A. Mendoza
M. Public Administration
National University of Singapore, 2008

Atty. Mayette M. Mendoza
Bachelor of Laws
San Beda College Manila, 2007

Atty. Ma. Aleta C. Nunez
Master of Laws
Columbia University, 2009

Engr. Ranel O. Padon
B.S. Geodetic Engineering
University of the Philippines Diliman, 2004

Engr. Wilfredo M. Rada
M.S. Applied Mathematics
University of the Philippines Diliman, 1995

Engr. Sheryl Rose C. Reyes
M.S. Remote Sensing
University of the Philippines Diliman, 2013

Engr. Therese Anne M. Rollan
M.S. Geomatics Engineering
University of the Philippines Diliman (in progress)

Engr. Mylene J. Villanueva
M.S. Geomatics Engineering
University of the Philippines Diliman, 2015

Support Staff

Ma. Elena C. Ignacio, MBA
Administrative Officer IV

Strata Ion C. Janio
Administrative Assistant III

DEPARTMENT OF GEODETIC ENGINEERING

Alfredo C. Gorio
Precision Instrument Technician III

CONTACT INFORMATION

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Email:

dgetcagp@coe.edu.ph

Website:

http://dge.upd.edu.ph/

6.8 UNDERGRADUATE PROGRAM CURRICULUM

BACHELOR OF SCIENCE IN GEODETIC ENGINEERING†

First Year

First Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units
GE (SSP 1) Kas 1[1] (Kasaysayan ng Pil)	3	0	3	GE (AH 2) Free Choice [2]	3	0	3
GE (SSP 2) Free Choice	3	0	3	GE (SSP 3) Philo 1 (Philo Analysis)	3	0	3
GE (AH 1) Free Choice [2]	3	0	3	Geol 11 (Principles of Geology)	3	0	3
GE (MST 1) Free Choice [3]	3	0	3	Math 53 (Elementary Analysis I)	5	0	5
Math 17 (Algebra and Trigonometry)	5	0	5	Chem 16 (General Chemistry I)	3	6	5
PE [4] (Physical Education)			(2)	PE [4] (Physical Education)			(2)
	17	0	**17**		17	6	**19**

Second Year

First Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units
GE (AH 3) Eng 10 (College English)	3	0	3	GE (AH 4) Fil 40 [1](Wika, Kultura at Lip)	3	0	3
Math 54 (Elementary Analysis II)	5	0	5	Math 55 (Elementary Analysis III)	3	0	3
Physics 71 (Elementary Physics I)	4	0	4	Physics 72 (Elementary Physics II)	4	0	4
Physics 71.1 (Elementary Physics I Lab)	0	3	1	Physics 72.1 (Elementary Physics II Lab)	0	3	1
ES 1 (Engineering Drawing)	0	6	2	GE 12 (General Surveying II)	2	6	4
GE 10 (General Surveying I)	2	3	3	GE 120 (Introduction to OOP)	1	6	3
PE [4] (Physical Education)			(2)	PE [4] (Physical Education)			(2)
NSTP [5](National Service Training Program)			(3)	NSTP [5] (National Service Training Program)			(3)
	14	12	**18**		13	15	**18**

Third Year

First Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units
Physics 73 (Elementary Physics III)	4	0	4	GE (AH 5) Comm 3 (Pract Speech Fund)	3	0	3
Physics 73.1 (Elementary Physics III Lab)	0	3	1	EEE 3 (Elementary Electrical Engg)	3	0	3
ES 11 (Statics of Rigid Bodies)	2	3	3	GE 118 (Hydrographic Surveying)	2	3	3
GE 117 (Const and Indust Surveying)	2	3	3	GE 128 (Adj Comp for Spatial Data Analysis)	3	0	3
GE 122 (Mathematical Methods in GE)	2	3	3	GE 152 (Ref Systems and Ref Frames)	3	3	4
GE 151 (Introduction to Geodesy)	3	0	3	GE 153 (Earth's Gravity & Geoid Model)	2	3	3
	13	12	**17**		16	9	**19**

Fourth Year

First Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units	Second Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units
GE (SSP 4) Free Choice	3	0	3	GE (MST 2) Free Choice [3]	3	0	3
ES 12 (Dynamics of Rigid Bodies)	2	3	3	PI 100 (The Life & Works of Jose Rizal)	3	0	3
GE 119 [a] (Property Surveying)	2	6	4	ES 13 (Mech of Deformable Bodies I)	3	0	3
GE 129 (Adj Comp for Geodetic App)	2	6	4	GE 149 (Contracts,Surveying Laws and Ethics)	2	0	2
GE 154 (Satellite Positioning Systems)	2	3	3	GE 155 (Geodetic Control Network)	2	0	2
				GE 155.1 (Hor Control Network Lab)	0	3	1
				GE 173 (Digital Cartography)	2	3	3
				GE 191 [b] (Practicum I)	1	0	1
	11	18	**17**		16	6	**18**
Summer							
GE 192 (Practicum II)		6	**2**				

Fifth Year

First Semester	Lect (hrs/wk)	Lab (hrs/wk)	Units		Lect (hrs/wk)	Lab (hrs/wk)	Units
GE (SSP 5) Free Choice	3	0	3	GE (MST 3) STS (Science, Tech & Society)	3	0	3
ES 15 (Mechanics of Fluids)	3	0	3	GE 148 (Land Registration Law)	3	0	3
GE 143 (Law on Natural Resources)	3	0	3	GIM 177 (Land Devt and Valuation)	2	3	3
GE 155.2 (Vert and Grav Network Lab)	0	3	1	GsE 189 (RS: Theory and Applications)	2	6	4
GIM 175 (GIS: Theory and Applications)	2	3	3	GE 199 [c] (Undergraduate Research)	0	12	4
GsE 188 (Modern Photogrammetry)	2	6	4	Elective [d]	3	0	3
GE 190 [c] (Seminar in GE, GsE and GIM)	1	0	1				
	14	12	**18**		13	21	**20**

Total Number of Units = **183**

Notes:

† *Effective AY 2010-2011. Total number of units = 183.*

[1] Kas 1 and Fil 40 satisfy the 6-unit Philippine Studies requirement

[2] Three (3) units of GE (AH) courses must be a Communication course in English

[3] Except for Math 1, GE (MST) Math, Physics, Chem, Geol, ES, GE, EEE cannot be credited as GE (MST) courses

[4] For physical education (PE), the student is required to complete any 4 physical education (PE) courses

[5] As a requirement for graduation, all students must take six (6) units in one of the National Service Training Program (NSTP) components: Civic Welfare Training Service (CWTS), Literacy Training Service (LTS), and Reserved Officer's Training Corps Military Science (ROTC Mil Sci)

[a] GE 119 requires students to be at least 4th year standing

[b] GE 191 must be taken in the 4th year second semester

[c] GE 190 and GE 199 requires students to be 5th year standing

[d] Electives are subject to approval of adviser

6. 9 GRADUATE PROGRAM CURRICULUM

Master of Science in Geomatics Engineering (M.S. GmE)

The M.S. GmE program offers only a thesis option track with the following minimum requirements:

Core courses	9 units
Common courses	6 units
Specialized courses	6 units
Electives	3 units
Thesis	6 units
T O T A L	**30 units**

The core courses contain the main topics in M.S. Geomatics Engineering that all students are required to take. The common courses provide a means for discussion of related topics between the different fields of specialization.

<table>
<tr><th colspan="3">Master of Science in Geomatics Engineering (M.S. GmE)</th></tr>
<tr><td>GEOINFORMATICS</td><td>REMOTE SENSING
and PHOTOGRAMMETRY</td><td>APPLIED GEODESY</td></tr>
<tr><td colspan="3">Core courses (9 units)</td></tr>
<tr><td colspan="3">GmE 202 Principles of Remote Sensing
GmE 203 Principles of GIS
GmE 205 Object-Oriented Programming for Geomatics Applications</td></tr>
<tr><td colspan="3">Common courses (6 units)</td></tr>
<tr><td colspan="3"><u>For All Fields of Specialization:</u>
ES 201 Advanced Mathematical Methods in Engineering I
ES 202 Advanced Mathematical Methods in Engineering II
ES 204 Numerical Methods in Engineering
IE 230 Statistical Design and Analysis for Engineers

<u>For Geoinformatics and Remote Sensing:</u>
Stat 276 Statistics for Geographic Information Systems
Stat 277 Statistics for Image Analysis

<u>For Remote Sensing and Applied Geodesy:</u>
GmE 211 Satellite Geodesy
GmE 216 Field Techniques in Applied Geodesy and RS

<u>For Geoinformatics and Applied Geodesy:</u>
GmE 210 Spatial Visualization
GmE 217 Cadastral Data Management</td></tr>
<tr><td colspan="3">Specialized courses (6 units)</td></tr>
<tr><td>GmE 220 Spatial Databases
GmE 221 Spatial Analysis
GmE 222 Advanced GIS
GmE 223 Integrated Spatial Systems</td><td>GmE 230 Microwave RS
GmE 231 Lidar RS
GmE 232 Hyperspectral RS
GmE 233 Close-Range Photogrammetry</td><td>GmE 241 Adjustments and Mathematical Geodesy
GmE 242 Satellite Positioning, Signal Processing and Numerical Methods
GmE 243 Satellite-Based Positioning Systems Development</td></tr>
<tr><td colspan="3">Electives (3 units)</td></tr>
<tr><td colspan="3">GmE 300 Thesis (6 units)</td></tr>
</table>

6. 10 UNDERGRADUATE PROGRAM COURSE DESCRIPTIONS

Geodetic Engineering (GE)

GE 10 General Surveying I. Use of principal surveying instruments; surveying measurements and error theory, basic plane surveying operations and computational method of position, horizontal and vertical distance measurements, traverse and areas; basic cartography. Prereq: Math 53. 5 h (2 class, 3 field) 3 u.

GE 11 Elementary Surveying. History and development of surveying; basic concepts of and instrumentation for surveying measurements; applications to engineering, geology, architecture and other disciplines.
Prereq: Math 17/equiv. 4 h (1 class, 3 field) 2 u.

GE 12 General Surveying II. Introduction to different surveying operations and techniques; control, topographic, hydrographic, and mine surveying; introduction to astronomic and satellite geodesy. Prereq: GE 10.
8 h (2 class, 6 field) 4 u.

GE 16 Elementary Photo-Interpretation. (For non-geodetic engineering students) Principles of photogrammetry; aerial photo-interpretation of cultural and natural features. Prereq: GE 10/11. 4 h (1 class, 3 lab) 2 u.

GE 117 Construction and Industrial Surveying. Route surveying: horizontal route alignment, route surveying, vertical route alignment, earthworks, construction surveys, construction management, computer aided design for construction and industrial surveying. Prereq: GE 12. 5 h (2 class, 3 field) 3 u.

GE 118 Hydrographic Surveying. Introduction to hydrographic surveying; sounding; bathymetry; precise instrumentations for hydrographic surveying; applications of hydrographic surveying. Prereq*:* GE12.
5 h (2 lec, 3 lab) 3 u.

GE 119 Land Surveying. Survey project controls; comparative equipment, procedures and precision; regulations governing property surveys in the country; transformation of coordinates to the Philippine Plane Coordinate System (PPCS), PRS 92, land management and administrative titling and survey requirements, basic CADD. Prereq: GE 12, Fourth year standing. 8 h (2 class, 6 field) 4 u.

GE 120 Introductory Object-Oriented Programming for Geospatial Applications. Concept of object-based and object-oriented programming; applications; control structures; arrays and methods; exception handling; graphics and GUI programming in developing numerical computation application for Geodetic Engineers. Prereq: GE 10.
7 h (1 lec, 6 lab) 3 u.

GE 122 Mathematical Methods in Geodetic Engineering. Matrices; systems of equations; interpolation; differentiation and integration; ordinary differential equations; linear differential equations; code development for numerical solutions. Prereq: Math 55, GE 120. 5 h (2 lec, 3 lab) 3 u.

GE 128 Adjustment Computations for Spatial Data Analysis. Concepts of measurement and error; statistical testing; variance-covariance propagation; error propagation in survey measurements; introduction to least square adjustments. Prereq: GE 122. 3 h (3 lec) 3 u.

GE 129 Adjustment Computation for Geodetic Applications. Standard and general least squares adjustment; adjustment of geodetic control network adjustment (trilateration, triangulation and traverse network; GPS adjustment); constraint equations. Prereq: GE 12, GE128. 8 h (2 lec, 6 lab) 4 u.

GE 143 Laws on Natural Resources. Pertinent provisions of the Civil Code on property and its ownership; study of the mining law, petroleum act, coal land act, modes of acquiring mineral lands; public land laws; forest laws; and others. 3 u.

GE 145 Mining Laws. Study of the Philippine mining law, the petroleum act and the coal land act, proper legal procedures for the application for mineral land leases and permits and the requisite for their final approval. 1 u.

GE 148 Land Registration Law. Fundamentals of the law on ordinary and cadastral land registration in connection with the Torrens system; Real Estate Development Laws, Indigenous Peoples Rights Act; Agrarian and Urban Land Reform. 3 h (3 lec) 3 u.

GE 149 Contracts, Surveying Laws and Ethics. Requisites of contracts; obligations of contracting parties; nullity and enforcement of contracts; stud of actual cases involving contract; Republic Act 9200 The Geodetic Engineering Law; Code of Ethical and Professional Standards; other surveying laws. Prereq: COI. 2 h (2 lec) 2 u.

DEPARTMENT OF GEODETIC ENGINEERING

GE 151 Introduction to Geodesy. History and development of geodesy; the international geodetic community; basic concepts in geodesy; positioning systems and positioning methods; time systems and time coordination; applications of geodesy. Prereq: GE 12. 3 h (3 lec) 3 u.

GE 152 Reference Systems and Reference Frames. Different kinds of reference systems and reference frames; geometry of the reference ellipsoid; computation of geodetic positions; coordinate transformation and map projections; International Terrestrial Reference Frames (ITRF); the Philippine Reference System (PRS). Prereq: GE 122, GE 151. 6 h (3 lec, 3 lab) 4 u.

GE 153 Earths Gravity and Geoid Modelling. Earths gravity field; normal and anomalous gravity field; geoid; height systems; geoid height modeling and methods; geoid models; geodynamics of the earth. Prereq: GE 151; Coreq: GE 152. 5 h (2 lec, 3 lab) 3 u.

GE 154 Satellite Positioning Systems. Introduction and overview of satellite-based positioning systems (SPS); orbit description; structure, acquisition and processing of SPS signals; mathematical methods for positioning using SPS; SPS surveying; processing transformation; error sources; software modules, SPS applications; prospects satellite geodesy. Prereq: GE 120, GE 152. Coreq: EEE3. 5 h (2 lec, 3 lab) 3 u.

GE 155 Geodetic Control Network. Principles and methods of the establishment and densification of geodetic control network including horizontal, vertical and gravity control network; accuracy standards and specifications of geodetic control network. Prereq: GE 154. 2 h lec. 2 u.

GE 155.1 Horizontal Control Network Laboratory. Project planning and implementation of a horizontal geodetic control network establishment and densification. Coreq: GE 155. 3 h (3 lab) 1 u.

GE 155.2 Vertical and Gravity Network Laboratory. Project planning and implementation of a vertical and gravity control network establishment and densification. Prereq: GE 129. Coreq: GE155. 3 h (3 lab) 1u.

GE 173 Digital Cartography. Overview of cartography; maps; mapping standards in the Philippines; terrain modeling; computer-aided design (CAD) for survey applications; basic Geo- graphic Information Systems (GIS). Prereq: GE 117, GE 118, GE 119. Coreq: GE 155. 5 h (2 lec, 3 lab) 3 u.

GE 190 Seminar in Geodetic and Geospatial Engineering and Geoinformatics. Undergraduate research proposal and data gathering. Prereq: Fifth year standing. 1 h (1 lec) 1 u.

GE 191 Geodetic and Geospatial Engineering and Geoinformatics Practicum I. On-the-Job Training Preparation. Prereq: Fourth year standing; must be taken in the 2nd semester of the academic year. 1 h (1 lec) 1 u.

GE 192 Geodetic and Geospatial Engineering and Geoinformatics Practicum II. On-the-job training. Prereq: Fourth year standing; must be taken during Summer of the academic year. Minimum of 144 h (2 lab) 2 u.

GE 198 Special Problems. Research and written report on various subjects or problems on geodetic engineering. Presentation and discussion of the written reports submitted by students before the class. Subjects to be assigned to students by the faculty in-charge. Prereq: Candidacy for graduation. 5 h (2 class, 3 lab) 3 u.

GE 199 Undergraduate Research. Undergraduate research proper and defense. Prereq: Fifth year standing. 12 h (12 lab) 4 u.

Geoinformatics (GIM)

GIM 175 Geographic Information Systems: Theory and Applications. Design and implementation of geographical information systems (GIS) and Spatial data management including: concept of information and GIS; georeferencing; spatial data modeling; spatial representation; geoprocessing; input/output operations; file storage; database management systems and distributed processing. GIS data models and structures. Spatial indexing. Algorithms for data manipulation, transformation. Spatial analysis and visualization. Techniques involved in project specification, design and implementation and the selection of computer hardware and software for GIS, Strategies and steps on GIS design and implementation. Interoperability, including internet-based handling of spatial data and web-based geo-information services. Prereq: COI. Coreq: GE 173. 5 h (2 lec, 3 lab) 3 u.

GIM 177 Land Development and Valuation. Land development patterns and concepts; growth and sustainability; land development design elements and processes; site analysis and land use planning; land valuation types; land valuation methods. Prereq: GE 175 or COI. Coreq: GE189. 5 h (2 lec, 3 lab) 3 u.

Geospatial Engineering (GsE)

GsE 188 Modern Photogrammetry. Mono and stereo photogrammetry; principles of vertical photography and stereoscopy; optics; image coordinate refinement; theory of orientation and aerial triangulation; digital image processing; DEM, contour and orthophoto generation; principles of satellite photogrammetry; close-range applications. Prereq: GE 129, GE 173. 8 h (2 lec, 6 lab) 4 u.

GsE 189 Remote Sensing: Theory and Applications. Fundamental concepts of remote sensing; electromagnetic radiation principles; history of aerial photography and space imaging; elements of visual interpretation; sensors and platform characteristics; digital image processing; information extraction; thermal infrared, microwave and LIDAR remote sensing; thematic mapping applications. Prereq: GE 188, EEE 3. 8 h (2 lec, 6 lab) 4 u.

REVITALIZED GENERAL EDUCATION COURSE

Geodetic Engineering (GE)

GE 1 Earth Trek. A guided exploration into the tools and techniques of earth observation and measurement. 3 u.

6. 11 GRADUATE PROGRAM COURSE DESCRIPTIONS

Geomatics Engineering (GmE)

GmE 202 Principles of Remote Sensing. Physical principles of remote sensing; environmental spectroscopy; remote sensing platforms; sensors and imaging systems; digital image interpretation and processing; applications of remote sensing. Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

GmE 203 Principles of Geographic Information Systems. Geographic information theory; data models and representation; data input and conversion; databases; spatial analysis. Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

GmE 205 Object-Oriented Programming for Geomatic Applications. Introduction to Object-Oriented Programming with applications to image processing, data acquisition and management, spatial data analysis, and visualization**.** Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

GmE 210 Spatial Visualization. Theory and application of both abstract and realistic visualization in two, three and four dimensions. Color theory; communication theory; cartography; map animation; hypermapping; environmental visualization; and augmented reality; three-dimensional modeling and transformations; perspective; hidden surface algorithms; illumination models; texture mapping; ray tracing; animation; applications of scientific and environmental visualization for planning and management in built and natural environments. Prereq: GmE 203. 5 h (2 lec, 3 lab) 3 u.

GmE 211 Satellite Geodesy. Theory and applications of modern satellite geodesy; theory and applications of satellite positioning, particularly in a geodetic context. Specific topics include: time systems, orbit computation, geodetic datum definition and coordinate systems, introduction to satellite positioning, error modeling, practical applications and considerations, data processing strategies, heights from GPS and geoid modeling and recent developments in satellite geodesy. Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

GmE 216 Field Techniques in Applied Geodesy and Remote Sensing. Field techniques for analysis, modeling and accuracy assessment in remote sensing and geographic information systems. Application in resource mapping, monitoring and prediction. Prereq: GmE 202, GmE 211. 5 h (2 lec, 3 lab) 3 u.

GmE 217 Cadastral Data Management. Introduction to Land Administration; Land Policy; Land Tenure and Security; Legal Aspects, Land Registration and Cadastre; Land Reform; Spatial Data Infrastructure; Land Information Systems; ICT and Land Administration; Information system modeling – UML Cadastral data analysis and modeling; Core Cadastral Domain Model; Marine cadastre; Property valuation and taxation. Prereq: GmE 203. 5 h (2 lec, 3 lab) 3 u.

GmE 220 Spatial Databases. Fundamentals of spatial databases; spatial data modeling including entity-relationship and object-oriented data models; indexes and access methods including B-trees, quadtrees, and R-trees; and query languages and query processing. Prereq: GmE 203. 5 h (2 lec, 3 lab) 3 u.

GmE 221 Spatial Analysis. Spatial data types; data structures for spatial data; point patterns; measures of dispersion, arrangements; patterns of lines; paths, branching, topology and concepts of distance; patterns of area; patterns in fields; the role of spatial scale and spatial aggregation problems; exploratory spatial data analysis; and spatial autocorrelation. Prereq: GmE 203. 5 h (2 lec, 3 lab) 3 u.

GmE 222 Advanced Geographic Information Systems. Theory and application of advanced techniques in resource estimation, prediction and evaluation using GIS. Design of GIS; Temporal GIS; 3-D GIS; Spatial data quality; Error propagation; Model integration/coupling with GIS; Agent-Based Modeling. Prereq: GmE 203. 5 h (2 lec, 3 lab) 3 u.

GmE 223 Integrated Spatial Systems. Fundamental concepts, theory, and applications of integrating spatial technologies with enabling technologies, such as wireless communications and the Internet: studies in positioning technologies and measurement integration; distributed GIS, web mapping, interoperability; location-based services. Prereq: GmE 203. 5 h (2 lec, 3 lab) 3 u.

GmE 230 Microwave Remote Sensing. Theory and application of microwave remote sensing in resource mapping, monitoring and prediction; Radar development; Side Looking Radars (SLAR); Synthetic Aperture Radar, Imaging polarimetry, interferometry, radar altimetry, passive microwave systems. Prereq: GmE 202. 5 h (2 lec, 3 lab) 3 u.

GmE 231 Lidar Remote Sensing. Principles, technologies and applications of Lidar ("Light Detection and Ranging") remote sensing; Laser ranging; Airborne laser scanning; Lidar system design; full-wave laser scanning; quantitative Lidar simulation; Lidar data retrieval; Lidar sensitivity and error analysis. Prereq: GmE 202. 5 h (2 lec, 3 lab) 3 u.

GmE 232 Hyperspectral Remote Sensing. Principles, technologies and applications of hyperspectral remote sensing; spectral matching; spectral mixing analysis; high-dimensional implications for supervised classification. Prereq: GmE 202. 5 h (2 lec, 3 lab) 3 u.

GmE 233 Close-Range Photogrammetry. Principle and methods of close-range digital photogrammetry; industrial, engineering and other applications of vision metrology. Prereq: GmE 202. 5 h (2 lec, 3 lab) 3 u.

GmE 241 Mathematical Geodesy and Adjustments of Geodetic Observations. Review of Least Squares Adjustments; Network deformation and analysis; Theory of Elasticity; Least-squares Collocation; Non-linear Adjustments; Datum Transformation Techniques; Ring Theory and Polynomial Theory as applied to problems in Geodesy. Prereq: COI. 5 h (2 lec, 3 lab) 3 u.

GmE 242 Satellite Positioning, Signal Processing and Numerical Methods. Space-based positioning systems (such as GPS) are used in conjunction with sophisticated mathematical modelling to solve the problems of determining 3-D position on and near the surface of the earth. Static and kinematic positioning with the Global Positioning System (GPS). Inertial positioning; astronomic positioning; VLBI positioning; satellite laser ranging. Horizontal, vertical and three-dimensional networks; pre-analysis and post-analysis; theory of heights; gravimetry; global and local geoid determination; astrogeodetic, gravimetric and combined methods; leveling by GPS and the geoid. Introduction to signal processing, time series analysis and FFT techniques. Kalman filtering. Prereq: GmE 211, GmE 241. 5 h (2 lec, 3 lab) 3 u.

GmE 243 Satellite-Based Positioning Systems (SBPS) Technology Development. SBPS receiver-software interface development; GPS functional library; GPS data platform and processing core; Concept of precise kinematic positioning and flight-State monitoring; precision estimation and comparisons. Applications of GPS Theory and Algorithms. Prereq: COI. 7 h (1 lec, 6 lab) 3 u.