

ASEAN Geodetic Engineering Information Exchange Framework

(v.2-04 October 2024)

Section 1: Education

1. Educational Institutions:

- **List of recognized universities and colleges offering geodetic engineering programs.**

There are 30 Higher Educational Institutions (HEI) -15 government and 15 private - offering the 4-year Bachelor of Science in Geodetic Engineering (BSGE) degree program accredited by the Commission on Higher Education (CHED). One HEI – Manuel S. Enverga University Foundation in Lucena City - offers the one-year Expanded Tertiary Education and Equivalency Accreditation Program (ETEEAP) for Geodetic Engineering – in addition to its regular 4-year BSGE degree program.

HEIs are recognized/accredited by the government pursuant to the provisions of CHED Memorandum Order (CMO) No. 89, series of 2017 – Policies, Standards, and Guidelines for the BSGE degree Program. The list of HEIs offering the BSGE degree program follows:

Government HEI (15)	Private HEI (15)
1. Bicol University-Legazpi City	1. Andres Bonifacio College - Dipolog
2. Bulacan Agricultural State College	2. Baguio Central University
3. Caraga State University – Butuan City	3. FEATI University - Manila
4. Eastern Visayas State University	4. Holy Trinity University-Puerto Princesa
5. Mountain Province State Polytechnic College – Tadian, Bontoc	5. Manuel S. Enverga University Foundation – Lucena City
6. Negros Oriental State University	6. St. John Paul II College of Davao
7. Nueva Vizcaya State University	7. Naga College Foundation
8. Pampanga State Agricultural University - Magalang	8. University of Northern Philippines-Vigan
9. Tarlac Agricultural University	8. Northwestern University – Laoag City
9. University of Southeastern Philippines - Davao City	10. University of La Salette-Santiago City
11. University of the Philippines-Diliman	11. Northeastern College – Santiago City
12. Visayas State University - Baybay	12. Saint Louis University - Baguio
13. Western Mindanao State University Zamboanga City	13. University of Northeastern Philippines – Iriga, Camarines Sur
14. University of Science and Technology of Southern Philippines – Cagayan de Oro City	14. University of Southern Philippines Foundation – Cebu City
15. Batangas State University	15. University of Saint Louis-Tuguegarao

- **Accreditation bodies and criteria**

Aside from the mandatory accreditation by CHED, the HEIs pursue further accreditation (not mandatory) by other bodies to demonstrate their commitment to quality education and to gain recognition both locally and internationally. The Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP) primarily accredits state universities and colleges.

For private institutions, accreditation is typically handled by voluntary accrediting agencies such as the Philippine Accrediting Association of Schools, Colleges and Universities (PAASCU) and the Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA). These agencies operate under the umbrella of the Federation of Accrediting Agencies of the Philippines (FAAP), which is authorized by CHED.

Accrediting agencies have different levels or stages (Candidate and Levels I-IV) of accreditation to reflect the quality and standards of educational programs and institutions. These levels help institutions and programs continuously improve and maintain high standards of education. Accreditation at higher levels often brings benefits such as increased funding opportunities, enhanced reputation, and greater student and faculty satisfaction.

2. Curriculum Overview:

- **Core subjects and electives.**

The core subjects and electives for the BSGE degree program are reflected in Section 11 of CMO No. 89, series of 2017 (**Annex 1**).

- **Duration and structure of programs (Bachelor's, Master's, Ph.D.).**

- **Bachelor's Degree Program:** The BSGE degree program can be completed in four (4) years and the curriculum is structured as follows:

- I. Technical Courses**

- (a) Mathematics and Basic Sciences – 16 units
 - (b) Basic Engineering Sciences – 18 units
 - (c) Allied Courses – 12 units
 - (d) Professional Courses – 79 units

Total Technical Courses: 125 units

- II. Non-Technical Courses**

- (a) Required General Education – 24 units
 - (b) General Education Electives – 9 units
 - (c) Mandated Course – 3 units
 - (d) Physical Education – 8 units
 - (e) National Service Training Program – 6 units

Total Non-Technical Courses: 50 credit units

Grand Total: 175 units

The number of lecture and laboratory hours allotted for each course is reflected in Section 11 of CMO No. 89, Series of 2017 – herein attached as Annex 1.

- **Master's Degree Program:** The Master of Science in Geomatics Engineering (GmE) program requires the completion of **30 units, two (2) years full-time**, which include:

- Core Courses - 6 units
- Common Courses - 6 units
- Specialized Courses - 3 units
- Electives - 3 units
- Thesis – 6 units

The fields of specialization in the MS GmE program include (a) Remote Sensing and Photogrammetry, (b) Applied Geodesy, and (c) Geoinformatics.

- **PhD Degree Program:** There is no approved doctorate program yet in Geodetic Engineering. [Note: A PhD program in Geomatics Engineering is being developed by the University of the Philippines Department of Geodetic Engineering and is proposed to be offered next year, AY 2025-2026].

3. Continuing Education:

- **Requirements for professional development.**

Professional development for Geodetic Engineers is governed by the Professional Regulation Commission (PRC) and the Professional Regulatory Board of Geodetic Engineering (PRBGE). The general requirement for continuing education includes compliance with the Continuing Professional Development (CPD) Act of 2016 [Republic Act (RA) No. 10912]. Under the CPD Act, licensed professionals must engage in CPD to renew their professional licenses. This includes attending seminars, workshops, and training programs that are accredited by the CPD Council. The CPD activities must be relevant to the practice of Geodetic Engineering. This includes advanced technical skills, new technologies, and emerging industry trends.

Through the CPD Accreditation System (CPDAS) portal, an initiative of the PRC, professionals can track their CPD points ensuring they meet the required points for license renewal.

- **Approved courses and training programs.**

Courses and training programs for CPD are endorsed and approved through a structured process managed by the PRC.

- Registered CPD providers submit their CPD courses/training programs which should include detailed information about the courses/programs, such as objectives, content, duration, and the qualifications of the resource persons.
- The submitted CPD courses/programs are evaluated by the CPD Council for Geodetic Engineering to ensure that the courses/programs meet the standards and requirements set by the PRC.
- If the CPD Council finds the program to be compliant with the standards, it endorses the program for approval. The PRC CPD Division then grants accreditation to the program, assigning it a specific number of CPD units.

Section 2: Licensure and Regulatory Laws

1. Licensing Authority:

- **Name and contact details of national licensing body.**

The national licensing body for Geodetic Engineers in the Philippines is the PRC, through the PRBGE. The PRC-PRBGE is responsible for regulating and supervising the practice of geodetic engineering to ensure that professionals meet the required standards of competence and ethics.

- **Website links for reference.**

- Website: Professional Regulation Commission
- Email: prc.helpdesk2@gmail.com
- Phone: (02) 8731-6617 / 8731-6618

2. Licensure Requirements:

To become a licensed Geodetic Engineer in the Philippines, the applicant must meet the following key requirements:

- **Educational Qualification - Bachelor's Degree.** The applicant must have a BSGE diploma from a CHED-recognized institution.

- **Documentary Requirements**

- Application Form
- Birth Certificate - certified true copy issued by the Philippine Statistics Authority (PSA).
- Official Transcript of Records - with a scanned picture and the remark "For Board Examination Purposes."
- Marriage Certificate (married female applicants) - a certified true copy of marriage certificate issued by the PSA.
- Payment for examination fee - PHP 900 for the complete exam or PHP 450 for conditioned/removal exams.

- **Examination requirements** – The applicant must pass the GELE, which basically covers the following subjects (pursuant to Section 14, RA No. 8560 – the Philippine Geodetic Engineering Act of 1998, as amended by RA No. 9200):

- Mathematics;
- Theory and Practice of Surveying;
- Property Surveying;
- Cartography and Photogrammetry;
- Geodesy, Geodetic Surveying and Least Squares;
- Engineering Surveys and Construction Surveying;
- Laws on Natural Resources;
- Laws on Obligations and Contracts; and
- Code of Ethics of the Profession

- **Experience requirement** – Not applicable

- **Additional Requirement – Rest Period.** If applicant fails the examination three times, he/she must wait for one year before reapplying.

- **Renewal processes and continuing education requirements**

A passer of the GELE will be issued by the PRC a license to practice as a Geodetic Engineer in the Philippines. He/she will also need to comply with the CPD requirements to maintain his/her license. Geodetic Engineers are typically required to earn 45 CPD units every three (3) years in order to renew their Professional Identification Cards (PIC)

3. Regulatory Laws, Rules, Regulations and Issuances:

- **Key regulations governing geodetic engineering practice.**

Geodetic Engineering practice is primarily governed by the following regulatory laws, rules, regulations and issuances:

- **RA No. 8560, as amended by RA No. 9200**

Also known as the Philippine Geodetic Engineering Act of 1998, this law regulates the practice of geodetic engineering in the Philippines. It defines the scope of geodetic engineering, the qualifications required to practice, and the responsibilities of geodetic engineers.

Section 2 of this law covers the following primary scope of services:

- (a) Project Control surveys
- (b) Property surveys (original, relocation, subdivision/consolidation)
- (c) Parcellary surveys
- (d) Engineering and construction surveys
- (e) Mineral land and mining surveys
- (f) Gravimetric and photogrammetric surveys
- (g) Mapping by geographic/land information systems

(h) Transfer of technology

○ **RA No. 9200**

This law amended Section 23, Article V, of RA No. 8560 providing for the automatic registration of practicing geodetic engineers without the need for an examination. This provision applied to all incumbent Junior Geodetic Engineers who had been actively practicing the geodetic engineering profession for at least three years.

Further, Section 6(b) of RA 9200 and Section 2 of Rule VIII of its Implementing Rules and Regulations (IRR) require that the upgraded Geodetic Engineers *“shall update their knowledge of the profession through continuing professional education or appropriate distance learning xxx WITHIN THREE (3) YEARS UPON APPROVAL OF THEIR APPLICATIONS.”*

The topics covered in the updating of knowledge, as detailed in Sections 2 and 3 of Rule IX of the aforementioned IRR of RA No. 9200, include the following modules/sub-modules:

(1) Module 1 - Geodetic Engineering Science

- Sub-Module 1A (Geodesy, Geodetic Surveying, Astronomy and Geomatics)
- Sub-Module 1B (Adjustment of Measurements)

(2) Module 2 - Geodetic Engineering Technology

- Sub-Module 2A (Photointerpretation, Photogrammetry and Remote Sensing)
- Sub-Module 2B (Property Surveys: Controls, Isolated, Cadastral, Mineral))
- Sub-Module 2C (Engineering Surveys: Subsidence, Construction)
- Sub-Module 2D (Mapping: Cartography, Projections, GIS, LIS)
- Sub-Module 2E (Computer Programming and Applications)

(3) Module 3 - Geodetic Engineering Laws

● **Other laws, regulations and issuances relevant to the practice of Geodetic Engineering:**

- **Presidential Decree (PD) No. 1529**, also known as the **Property Registration Decree**, governs the registration of lands and properties under the Torrens system, including the requirements and procedures for land surveys and the issuance of titles.
- **Commonwealth Act No. 141**, also known as the **Public Land Act**, governs the classification, administration, and disposition of lands of the public domain in the Philippines.

- **Cadastral Act (Act No. 2259)**: provides for the systematic survey and registration of lands, particularly those of the public domain.
- **Republic Act No. 10023 (Residential Free Patent Act)**: allows for the issuance of free patents for residential lands, simplifying the process for land titling and registration.
- **RA No.11201**: created the Department of Human Settlements and Urban Development (DHSUD) and includes provisions related to urban development, housing, and land use planning, which are essential for surveying and mapping activities.
- **RA No. 8371, or “The Indigenous Peoples’ Rights Act of 1997”** provided guidelines for the detailed surveying and mapping of ancestral domains and ancestral lands prior to the issuance of Certificates of Ancestral Domain Titles (CADTs) and Certificates of Ancestral Land Titles (CALTs)
- **Department of Environment and Natural Resources (DENR) Administrative Orders**

These administrative orders provide guidelines for surveying practices:

- (1) DAO 2007-29: the revised detailed rules and regulations for the conduct of land surveys, ensuring that all Geodetic Engineers and other concerned stakeholders have clear guidelines to follow.
 - (2) DAO No. 2010-17: rules and regulations on the conduct of inspection, verification, and approval of surveys (IVAS).
 - (3) DAO No. 2005-13: revised guidelines for the implementation of the Philippine Reference System of 1992 (PRS92).
 - (4) DAO No. 2010-18: Improving Managing of Land Information Through the Adoption of Land Administration Management Systems (LAMS)
 - (5) DAO 2016-01: Adoption of Digital Land Survey Data (DLSD) Lodgment as a Standard Format for the Submission and Exchange of Survey Data in Digital Form under the LAMS
- DENR Memorandum Circular (MC) No. 2010-06: Manual of Procedures on the Transformation and Integration of Cadastral Data into the Philippine Reference System of 1992 (PRS92)
 - DENR MC No. 2010-13: Manual of Survey Procedures
 - Land Management Bureau (LMB) MC No. 2017-003: Adoption of the Alternative Use of Unmanned Aerial Systems (UAS) in the Conduct of Land Surveys
 - LMB Technical Bulletin No. 2, Series of 2017: Guidelines on the Use of Unmanned Aerial Systems (UAS) in Support of Land Survey

- RA No. 6657: Comprehensive Agrarian Reform Act, as amended by RA No. 9700
- Department of Agrarian Reform Administrative Order No. 2, Series of 2019: Guidelines and Procedures on the Parcelization of Landholdings with Collective Certificates of Land Ownership (CLOA) Awards
- Department of Public Works and Highways (DPWH) Design Guidelines Criteria and Standards, Volume 2B – Topographic Surveys: provides survey and mapping guidelines for detailed engineering surveys required in the design of highway projects, bridge projects, water engineering projects and building projects.

- **Ethical standards and professional conduct guidelines.**

The ethical standards and professional conduct of geodetic engineers are primarily governed by the **Code of Ethical and Professional Standards for the Geodetic Engineering Profession** adopted by the PRBGE (Board Resolution No. 03, Series of 2003). The Code serves as a guide to ensure that geodetic engineers practice their profession with integrity, competence, and respect for the public and the environment and primarily covers the following norms of conduct:

- (a) **integrity and honesty** - upholding the highest standards of integrity and honesty in their professional services.
- (b) **competence** - maintaining a high level of competence and continuously improving skills and knowledge.
- (c) **humility and respect** – recognizing the Creator as the source of professional path and showing respect to clients and colleagues.
- (d) **public welfare** - ensuring that their work benefits the public and does not harm the environment or society.
- (e) **confidentiality** - respecting the confidentiality of client information and not using it for personal gain.

Section 3. Standards Utilization

1. International Standards

- **List of relevant international standards**

- (a) **Geodetic Surveys**

- **FGCS Standards and Specifications for Geodetic Control Networks:** developed by the US Federal Geodetic Control Subcommittee, this provides detailed guidelines for establishing and maintaining geodetic control networks.

- (b) **Hydrographic Surveys**

- **IHO S-44 Standards for Hydrographic Surveys:** developed by the International Hydrographic Organization (IHO), this provides detailed guidelines on the specifications for conducting hydrographic surveys to ensure the safety of navigation and the protection of the marine environment.

(c) Drone (Unmanned Aerial Systems) Surveys

- **ISO 21384-3:2019 Unmanned Aircraft Systems – Part 3: Operational Procedures:** This standard specifies the requirements for the safe operation of unmanned aircraft systems.

(d) Photogrammetry, Remote Sensing and Geographic Information Systems

The following standards help ensure the accuracy, consistency, and interoperability of photogrammetric and remote sensing data, which are critical for various applications in geospatial sciences.

- **ISO/TC 211 Geographic Information/Geomatics:** This technical committee develops a wide range of standards for geographic information and geomatics, including those relevant to photogrammetry and remote sensing.
- **Open Geospatial Consortium (OGC) Standards:** OGC develops standards to ensure the interoperability of geospatial data and services, which are essential for integrating photogrammetric and remote sensing data.
- **ASPRS Positional Accuracy Standards for Digital Geospatial Data:** developed by the American Society for Photogrammetry and Remote Sensing (ASPRS), these standards provide guidelines for assessing the positional accuracy of digital geospatial data.

● Adoption and adaptation of international standards in local practice.

The above-listed international standards are adopted by the National Mapping and Resource Information Administration (NAMRIA) – the national mapping agency of the Philippines – through its Mapping and Geodesy Branch, Hydrography Branch, Resource Data Analysis Branch and Geospatial Information System Management Branch.

For other agencies with surveying and mapping functions, such as the Department of Environment and Natural Resources (DENR) and the Department of Public Works and Highways (DPWH), the above-listed international standards are adopted in their procedures and outputs.

2. National Standards

- **Overview of national standards for geodetic engineering.**

The national standards for surveying and mapping are patterned after the NAMRIA technical specifications and procedures particularly in the establishment of geodetic control networks across the Philippines. From these control networks, other stakeholders (government agencies and private practitioners) take off to establish project controls (horizontal and vertical) for various infrastructure projects.

- **Key differences between national and international standards.**

Both national and international standards, in general, follow similar guidelines in terms of equipment, software and data processing routines.

One basic difference is in the presentation of the accuracy of outputs for control networks: the present national format presents accuracy as a linear measure, while the international standard presents geodetic control accuracy as a circular measure. The transition from a linear accuracy measure to a circular accuracy format is one of the topics in the ongoing revision of the Manual for Land Surveys in the Philippines.

3. Implementation and Compliance

- **Procedures for implementing standards.**

The procedures for the implementation of the standards are detailed in the Manual for Land Surveys of the Philippines published by the DENR. These procedures are adopted by other stakeholders engaged in surveying and mapping.

Section 4: Local Laws on Permits

1. Permit Requirements:

- **Types of permits required for various geodetic engineering activities.**

- (a) For DENR surveys, a Survey Order or Survey Authority is required to be secured by a Geodetic Engineer before the survey can be conducted. The order or authority is signed by a DENR official based on the scope of survey and pursuant to the matrix in DAO 2016-07 (DENR Manual of Authorities on Technical Matters):

DENR Scope of Survey	Approving Authority
Cadastral surveys and public land subdivision; political boundary - within the same region or local government unit (LGU); isolated; reclamation; townsite reservation and group settlement; LGU lands; national parks and protected areas and watershed reservation (within the same region); foreshore land (more than 100 hectares)	Regional Director

Political boundary (Inter-regional); national parks and protected areas and watershed reservation (inter-regional); survey covered by special law;	Land Management Bureau Director
Foreshore lands (12-100 hectares);	Assistant Regional Director for Technical Services
Subdivision of cadastral lots	Provincial Environment & Natural Resources Officer
Isolated/original and simple subdivision of public lands; foreshore land (less than 12 hectares)	Community or City Environment & Natural Resources Officer

(b) For drone or unmanned aerial surveys, these are regulated by the CAAP through several guidelines and standards to ensure safety and compliance - pursuant to Philippine Civil Aviation Regulations for Remotely-Piloted Aircraft Systems (RPAS). The following certificates must be obtained by Geodetic Engineers who will conduct drone surveys:

- RPAS Controller Certificate: Required for individuals operating drones commercially.
- RPAS Registration Certificate: Required for registering the drone itself.
- RPAS Operator Certificate: Required for businesses using drones for commercial purposes, such as aerial photography or construction surveying.

3. Compliance and Inspections:

- Inspection requirements and processes.

For DENR surveys, the DENR issued DAO No. 2010-17: Rules and Regulations on the Conduct of Inspection, Verification, and Approval of Surveys (IVAS) to ensure compliance by Geodetic Engineers of the guidelines on the conduct of surveys.

For detailed engineering surveys (for highways, bridge sites and other infrastructure), the Department of Public Works and Highways (DPWH) engages the services of a Geodetic Engineer through an independent consultant firm to ensure that the survey contractor complies with the DPWH survey guidelines.

Section 5: Geodetic Datums, Map Projections and Map Scales

(1) Geodetic Datums

(a) **The Philippine Reference System of 1992 (PRS92)**, established through Global Positioning System (GPS) measurements, serves as the primary

geodetic reference frame for all surveying and mapping activities in the Philippines.

- (b) Philippine Geocentric Datum 2020 (PGD2020)**, based on the International Terrestrial Reference Frame, and established through continuously (24/7) operating reference stations across the Philippines. This datum will replace PRS92 pursuant to the Philippine Geodetic Reference System Modernization Project.

(2) Map Projections

Different map projections are used for cadastral and topographic maps and nautical charts:

(a) Cadastral Maps

Cadastral maps are plotted using the Philippine Reference System 1992-Philippine Transverse Mercator (PRS92-PTM) projection

(b) Topographic Maps

The NAMRIA primarily uses the Universal Transverse Mercator (UTM) projection for topographic maps. These maps are based on the Clarke 1866 ellipsoid. The UTM projection is widely used because it minimizes distortion over small areas, making it suitable for detailed mapping.

(c) Nautical Charts

For nautical charts, NAMRIA employs the Mercator projection. This projection is particularly useful for navigation because it represents lines of constant course, known as rhumb lines, as straight segments, which simplifies plotting a course over long distances.

(3) Map Scales

Various scales for cadastral and topographic maps and nautical charts are used:

(a) Cadastral Maps

- 1:4,000 - standard scale for cadastral maps

(b) Topographic Maps

- 1:250,000 - Used for broad regional mapping.
- 1:50,000 - Commonly used for detailed regional mapping.
- 1:10,000 - Used for urban and metropolitan areas, such as Metro Manila.
- 1:5,000 - The largest scale, used for detailed mapping of specific urban areas like Bacolod City, Metro Cebu, and Cagayan de Oro.

(c) Nautical Charts

- 1:50,000 and larger - Harbor charts for detailed navigation in ports and harbors.
- 1:50,001 to 1:100,000 - Coastal charts for navigation along the coastlines.
- 1:100,001 to 1:600,000 - General charts for broader navigation purposes.
- 1:600,001 and smaller - Sailing charts for long-distance navigation.

These scales help ensure that the maps and charts are suitable for their intended purposes, whether for detailed land surveying or safe maritime navigation.

Section 6: MRA Compliance

1. Mutual Recognition Agreements:

- **MRA applicable to geodetic engineering within ASEAN.**

ASEAN MRA on Engineering Services

2. Harmonization Efforts:

- **Harmonization of standards, codes and regulations**
(Under process)
- **Platforms for collaboration and information exchange.**
 - Platforms to facilitate knowledge exchange amongst AMS can include joint workshops, seminars, and conferences where best practices and innovations in surveying are shared. Examples: The International Conferences on the ASEAN Qualifications Reference Framework (AQRF) in October 2023 and August 2024 in Pasay City, Philippines, funded by the Philippines Department of Foreign Affairs and organized by the PRC through the International Affairs Office and the PRBGE.
 - Platforms can include regional workshops utilizing the extensive network of the International Federation of Surveyors (FIG) to bring in international experts to provide insights and training.

Section 7. Safety Standards and Practices

1. Occupational Safety and Health:

- **Key safety standards applicable to geodetic engineering.**

These standards and guidelines help ensure the safety and well-being of geodetic engineers while they perform their essential tasks. This includes compliance with occupational health and safety standards. Safety and health

responsibilities for geodetic engineers, include risk assessment, personal protective equipment (PPE), and safe working practices

- **Best practices for ensuring workplace safety.**

- (i) **PPE:** Geodetic Engineers should wear appropriate PPE, including high-visibility clothing, hard hats, safety boots, and eye protection, to minimize risks from environmental hazards.
- (ii) **Hazard Assessment:** Conducting thorough hazard assessments before starting any surveying project is crucial. This includes identifying potential risks such as uneven terrain, traffic, and weather conditions.
- (iii) **Emergency Procedures:** Establishing clear emergency procedures, including first aid and evacuation plans, is vital for handling accidents or unexpected incidents.

- **Safety training requirements.**

- **Training programs:** Ensuring that all geodetic engineers are adequately trained and competent in using surveying equipment and understanding safety protocols is essential.

- **Additional Safety Guidelines in Using Drones for Surveying**

To ensure the safe and effective use of drones for surveying and applications in the Philippines, the Civil Aviation Authority of the Philippines (CAAP) has issued the following guidelines:

- (i) **No-Fly Zones:** Drones are prohibited from flying in certain areas, such as near airports, military bases, and densely populated areas.
- (ii) **Altitude and Distance Limits:** Drones must be operated within specific altitude (not to exceed 122 meters) and distance limits to ensure safety and avoid interference with manned aircraft.
- (iii) **Visual Line of Sight (VLOS):** Operators must maintain a visual line of sight with their drones at all times during flight.
- (iv) **Insurance and Liability:** Operators are encouraged to have insurance coverage for their drones to cover potential damages or accidents.
- (v) **Privacy and Data Protection:** While there are no specific laws regarding drone or unmanned aerial vehicle (UAV) recording capabilities, operators must comply with the Data Privacy Act to ensure the protection of personal data.

Section 8: Environmental Regulations

- **Guidelines for implementing sustainable and eco-friendly practices in geodetic engineering.**
 - **DENR Memorandum Circulars:** Various circulars issued by the DENR provide guidelines for ensuring that geodetic engineering projects comply with environmental standards. These include requirements for minimizing environmental disruption during surveys and ensuring proper waste management.
 - **Key Environmental Considerations**
 - (a) **Minimizing Land Disturbance:** Geodetic engineers are required to minimize land disturbance and avoid sensitive areas such as protected forests and watersheds.
 - (b) **Waste Management:** Proper disposal of waste materials generated during surveying activities is mandated to prevent environmental contamination.
 - (c) **Restoration and Rehabilitation:** After completing a project, geodetic engineers must restore the surveyed area to its original condition as much as possible.

These regulations ensure that geodetic engineering projects are conducted responsibly, with due consideration for their environmental impact.

Section 9: Technology and Innovation

1. Emerging Technologies:

- **Overview of emerging technologies in the field of geodetic engineering.**

Emerging technologies are significantly transforming the field of geodetic engineering and surveying, enhancing accuracy, efficiency, and data integration.

(a) **Unmanned Aerial Systems (UAS)**

Drones equipped with high-resolution cameras and LiDAR sensors are revolutionizing data collection. They provide rapid, accurate, and cost-effective surveys, especially in hard-to-reach areas.

(b) **LiDAR (Light Detection and Ranging)**

LiDAR technology is used for creating high-resolution digital elevation models (DEMs) and 3D models. It is particularly useful in topographic mapping, forestry, and urban planning.

(c) **Global Navigation Satellite Systems (GNSS)**

Advancements in GNSS, including multi-constellation and real-time kinematic (RTK) positioning, are improving the precision and reliability of geospatial data.

(d) Mobile Mapping Systems

These systems integrate GNSS, LiDAR, and imaging sensors on mobile platforms (vehicles, backpacks) to collect geospatial data efficiently over large areas.

(e) Artificial Intelligence (AI) and Machine Learning

- Modern photogrammetry, enhanced by AI and machine learning, allows for the automated processing of aerial and satellite imagery to create accurate 3D models and maps.
- AI and machine learning algorithms are being used to process and analyze large datasets, improving the accuracy and efficiency of geospatial data interpretation.

(f) Hyperspectral Imaging in Remote Sensing

Technologies like Synthetic Aperture Radar (SAR) and hyperspectral imaging are providing detailed and diverse data for environmental monitoring, disaster management, and resource exploration.

(g) Building Information Modeling (BIM)

BIM integrates 3D modeling with geospatial data, facilitating better planning, design, and management of construction projects.

(h) Cloud-based Geographic Information Systems (GIS)

This provides real-time access, processing, and sharing of geospatial data, improving collaboration and decision-making.

These technologies are driving innovation in geodetic engineering, making it possible to collect, process, and analyze geospatial data more accurately and efficiently than ever before.

● Adoption and integration of new technologies into practice.

Geodetic engineers are increasingly adopting new technologies to enhance the efficiency, accuracy, and scale of their projects, with tools like LiDAR, GNSS and drones now commonly used for urban planning, disaster risk reduction, and environmental management. To keep pace with these advancements, universities and technical institutions are updating their curricula, ensuring that new graduates are equipped with modern skills. However, challenges remain, as the high cost of some technologies and a lack of local expertise in certain areas can slow down adoption, particularly among smaller firms and individual practitioners and in rural regions.

Survey-grade Lidar technology and mobile mapping are still limited to the larger surveying firms in view of their relatively high costs. AI and machine learning, hyperspectral imaging and cloud-based GIS are used in academic

research projects and at the NAMRIA. BIM has not yet been adopted by local practitioners in view of the prohibitive software cost.

2. Research and Development:

- **Key research institutions and areas of ongoing research.**

In the Philippines, several key institutions are at the forefront of geodetic research and development. The University of the Philippines Department of Geodetic Engineering (UP DGE) and the UP Training Center for Applied Geodesy and Photogrammetry (UP TCAGP) are leading research efforts in geodetic and geomatics engineering. The NAMRIA is crucial in geodetic research, focusing on national geospatial data collection and management. Additionally, the Caraga Center for Geo-Informatics contributes to advancing geospatial technologies in Mindanao. The Department of Science and Technology (DOST) also plays a significant role by supporting various research initiatives and technological advancements in the field.

- **Funding opportunities and collaboration platforms for innovation.**

Funding opportunities and collaboration platforms for innovation in geospatial research in the Philippines include several key sources.

The Department of Science and Technology (DOST) provides crucial funding through programs like the DOST-PCIEERD (Philippine Council for Industry, Energy and Emerging Technology Research and Development), which offers grants for research and development projects.

The Philippine Space Agency (PhilSA) supports the use of satellite data and promotes research in space technology, including remote sensing and GIS applications for monitoring natural resources and managing disasters.

Additionally, government agencies such as the DENR and the DPWH collaborate with academic institutions on projects related to land use planning, environmental conservation, and infrastructure development.

Internationally, geodetic engineers engage in research projects and forums with organizations such as the International Federation of Surveyors (FIG), the International Association of Geodesy (IAG), and the International Society for Photogrammetry and Remote Sensing (ISPRS) facilitating global collaboration and knowledge exchange.

. Section 10: Professional Networking and Associations

1. Professional Associations:

- **List of national and regional professional associations for geodetic engineers.**

The accredited integrated professional organization of Geodetic Engineers is the **Geodetic Engineers of the Philippines, Inc. (GEPI)**. There are 15 regional divisions representing the different administrative regions of the Philippines.

In addition, there is a **Mines Geodetic Engineers, Inc. (MGEI)** – an organization of Geodetic Engineers who have been deputized by the DENR Mines Geosciences Bureau to undertake mineral land and mining surveys. The MGEI operated under the umbrella of the GEPI.

- **Membership benefits and requirements.**

Membership in the GEP offers several benefits aimed at professional growth and development.

(a) Professional Development

- **Training and Seminars:** Members have access to various training programs, seminars, and workshops that help them stay updated with the latest advancements and best practices in geodetic engineering.
- **Conventions and Conferences:** GEP organizes annual conventions and conferences where members can network, share knowledge, and learn from industry experts.

(b) Certification and Recognition

- **Professional Recognition:** Being a member of GEP provides recognition as a qualified and certified geodetic engineer, which can enhance professional credibility.
- **Continuing Professional Development (CPD):** GEP offers CPD programs that help members meet the requirements set by the PRC for license renewal.

(c) Networking Opportunities

- **Community Engagement:** Members can connect with other geodetic engineers through regional chapters and special interest groups, fostering a sense of community and collaboration.

(d) Advocacy and Representation

- **Professional Advocacy:** GEP represents the interests of geodetic engineers in various forums and works to promote the profession at the national and international levels.
- **Policy Influence:** Members have the opportunity to participate in discussions and initiatives that influence policies and regulations affecting the geodetic engineering profession.

2. Networking Opportunities:

- **Conferences, seminars, and workshops for professional development.**

On an annual basis, the GEP organizes one national directorate meeting and annual convention, 4 area assemblies (North Luzon, South Luzon, Visayas and Mindanao), and 15 regional division conventions. There are also seminars/workshops organized by the GEP chapters comprising the regional divisions. In addition, the GEP conducts various technical seminars and workshops on geodetic engineering practice related topics with expert resource persons from government, industry and academe.

- **Platforms for peer-to-peer networking and knowledge exchange.**

Platforms and organizations where geodetic engineers in the Philippines can engage in peer-to-peer networking and knowledge exchange:

1. PRC-based programs which include professional summits, seminars, workshops, and technical lectures. These programs are great opportunities for networking and learning from peers.
2. GEP-based regular conferences, seminars, and workshops which are excellent for networking and staying updated on the latest developments in the field.
3. Social media including various Facebook groups and LinkedIn communities where geodetic engineers share knowledge, discuss challenges, and network with each other.
4. International Conferences and Workshops: Participating in international events such as the biennial Southeast Asia Survey Congress (SEASCO) organized by the ASEAN Federation of Land Surveying and Geomatics (AFLAG), FIG Working Week conferences organized by the International Federation of Surveyors, and Technical Commission seminars organized by the International Society for Photogrammetry and Remote Sensing (ISPRS) can also provide valuable networking opportunities with our peers from other countries.

These platforms can help Geodetic Engineers stay connected with fellow professionals and keep up with the latest trends and technologies in geodetic engineering.

Section 11: Case Studies and Best Practices

1. Successful Projects:

- **Case studies of successful geodetic engineering/surveying projects within ASEAN.**

(a) Singapore's Smart Nation Initiative

Singapore has implemented various smart city projects that utilize advanced surveying and geospatial technologies. One notable project is the development of a 3D digital twin of the entire city. This digital twin integrates data from various sources, including LiDAR, photogrammetry, and GNSS, to create a highly detailed and accurate model of the urban environment. This model is used for urban planning, infrastructure management, and disaster response. (Source: <https://www.smartnation.gov.sg>)

(b) Indonesia's One Map Policy

Indonesia's One Map Policy aims to create a single, unified map that integrates all geospatial data from different government agencies. This initiative helps resolve land disputes, improve land management, and support sustainable development. The project involves extensive surveying and mapping efforts, including the use of remote sensing and GIS technologies. (Sources: Abidin, et al. (2021), One Map Policy of Indonesia: Status, Challenges and Prospects; FIG e-Working Week 2021, Smart Surveyors for Land and Water Management – Challenges in a New Reality Virtually in the Netherlands, 21-25 June 2021)

(c) Thailand's Land Titling Project

Thailand's Land Titling Project, supported by the World Bank, aimed to improve land tenure security and promote efficient land markets. The project involved extensive cadastral surveys and the establishment of a comprehensive land information system. It successfully issued millions of land titles, enhancing property rights and boosting economic development. (Source: Williamson, Ian (1990), Australian Surveyor, Volume 35, 1990 – Issue 4)

(d) Vietnam's Coastal Zone Management

Vietnam has implemented several projects focused on coastal zone management and disaster risk reduction. These projects involved detailed hydrographic surveys and the use of remote sensing technologies to monitor coastal erosion, sea-level rise, and other environmental changes. The data collected supports sustainable coastal development and disaster preparedness. (Source: Sekhar, Nagotha Udaya (2005), Integrated Coastal Zone Management in Vietnam: Present Potentials and future challenges, Science Direct, Volume 48, Issues 9-10, 2005, pages 813-827)

(e) Philippines' National Cadastral Survey Program

The Philippines' National Cadastral Survey Program aimed to systematically survey and map all municipalities to identify and delineate individual land claims. This program helps in issuing titles or patents and delineating political boundaries. It involved extensive field surveys, the use of GNSS, and the integration of geospatial data. (Source: <https://lmb.gov.ph>)

These case studies highlight the successful application of surveying and geospatial technologies in addressing various challenges and promoting sustainable development within ASEAN.

- **Key lessons learned and best practices.**

The notable surveying projects within ASEAN have provided several key lessons and best practices that can be applied to future initiatives.

(a) Key Lessons:

- **Integration of Technologies:** Successful projects often integrate multiple technologies, such as GNSS, LiDAR, photogrammetry, and remote sensing. This integration enhances data accuracy and provides comprehensive insights.
- **Stakeholder Collaboration:** Effective collaboration among government agencies, private sector, and local communities is crucial. Projects like Indonesia's One Map Policy highlight the importance of coordinated efforts to achieve common goals.
- **Capacity Building:** Investing in training and capacity building for local professionals ensures the sustainability of projects. Thailand's Land Titling Project emphasized the need for continuous education and skill development.
- **Community Engagement:** Engaging local communities in the planning and implementation phases helps in gaining their support and addressing their needs. This approach was vital in Vietnam's Coastal Zone Management projects.
- **Policy Support:** Strong policy frameworks and government support are essential for the success of large-scale surveying projects. The Philippines' National Cadastral Survey Program benefited from clear policies and administrative backing.

(b) Best Practices

- **Standardization of Procedures:** Adopting standardized procedures and guidelines ensures consistency and reliability in data collection and processing. This practice was evident in Singapore's Smart Nation Initiative.
- **Use of Open Data:** Promoting the use of open data and sharing geospatial information among stakeholders can enhance transparency and collaboration. Indonesia's One Map Policy is a prime example of this approach.

- **Sustainability Focus:** Incorporating sustainability principles in project planning and execution helps in minimizing environmental impact and promoting long-term benefits. Vietnam's coastal projects prioritized sustainable development.
- **Utilizing Local Knowledge:** Utilizing local knowledge and expertise can improve the relevance and effectiveness of projects. Community involvement in Thailand's Land Titling Project provided valuable insights.
- **Continuous Monitoring and Evaluation:** Implementing robust monitoring and evaluation mechanisms ensures that projects stay on track and achieve their objectives. Regular assessments were a key component of the Philippines' cadastral surveys.

These lessons and best practices can guide future surveying and geospatial projects, helping to ensure their success and sustainability.

Section 12: Legal and Ethical Considerations

1. Legal Framework:

- **Overview of the legal framework governing geodetic engineering practice.**

The legal framework governing the practice of geodetic engineering in the Philippines is primarily established by **RA No. 8560**, also known as the **Philippine Geodetic Engineering Act of 1998** as amended by RA No. 9200. It regulates the practice of geodetic engineering in the Philippines, ensuring that only qualified individuals engage in the profession.

The act mandates that only individuals who have passed the licensure examination for geodetic engineers and have been issued a Certificate of Registration by the PRBGE can practice the profession. The PRC oversees the implementation of the act, including the administration of licensure examinations and the regulation of the practice of geodetic engineering.

The act includes provisions for a Code of Ethical and Professional Standards that all registered geodetic engineers must adhere to. This ensures the integrity and professionalism of the practice.

The act specifies penalties for violations, including practicing without a license, fraudulent activities, and other unethical practices. The PRC, along with the PRBGE, is responsible for enforcing the provisions of the act and taking disciplinary actions against violators.

This legal framework ensures that the practice of geodetic engineering in the Philippines is conducted by qualified professionals who adhere to high standards of accuracy, ethics, and professionalism.

- **Key legal considerations for engineers working in different ASEAN countries.**

Working as an engineer or surveyor in different ASEAN countries involves navigating various legal considerations to ensure compliance and professional integrity.

(a) Licensing and Certification

Local Registration Requirements: Engineers and surveyors must comply with the licensing and certification requirements of the host country. This may require compliance with specific educational and experience criteria.

(b) Compliance with Local Laws and Regulations

Domestic Laws: Foreign professionals must adhere to the domestic laws and regulations governing engineering and surveying practices in the host country. This includes building codes, environmental regulations, safety standards and high ethical standards and professional conduct.

(c) Collaboration with Local Professionals

Partnerships: Foreign engineers and surveyors often need to work in collaboration with local professionals. This ensures compliance with local regulations and facilitates knowledge transfer.

By understanding and adhering to these legal considerations, engineers and surveyors can ensure their practices are compliant and professional, fostering successful cross-border collaborations within ASEAN.

2. Ethical Dilemmas:

- **Common ethical dilemmas faced by geodetic engineers.**

Geodetic engineers in the Philippines, like professionals in many fields, encounter various ethical dilemmas in their practice.

(a) Conflict of Interest

- **Scenario:** A geodetic engineer might be asked to conduct a survey for a project in which they have a personal or financial interest.
- **Dilemma:** Balancing personal interests with professional responsibilities can be challenging. Geodetic Engineers must avoid situations where their impartiality could be compromised.

(b) Accuracy vs. Cost

- **Scenario:** Clients may pressure engineers to cut costs, potentially compromising the accuracy and quality of the survey.
- **Dilemma:** Geodetic Engineers must ensure that their work meets professional standards and ethical guidelines, even if it means higher costs.

(c) Signing Off on Others' Work

- **Scenario:** An engineer might be asked to sign off on survey results or plans prepared by others without proper verification.
- **Dilemma:** This practice can lead to inaccuracies and legal liabilities. Geodetic Engineers must ensure they thoroughly review and verify all work before endorsing it.

(d) Bribery and Corruption

- **Scenario:** Geodetic Engineers may face situations where they are offered bribes to alter survey results or expedite processes.
- **Dilemma:** Accepting bribes undermines the integrity of the profession and can lead to severe legal consequences. Geodetic Engineers must adhere to ethical standards and report any such attempts.

(e) Client Confidentiality

- **Scenario:** Geodetic Engineers often handle sensitive information related to land ownership and boundaries.
- **Dilemma:** Maintaining client confidentiality while complying with legal requirements for data sharing can be complex. Geodetic Engineers must balance transparency with privacy concerns.

(f) Professional Competence

- **Scenario:** Geodetic Engineers may be asked to undertake projects beyond their expertise or without adequate resources.
- **Dilemma:** Accepting such projects can lead to substandard work and potential harm. Geodetic Engineers must recognize their limitations and seek additional expertise when necessary.

● **Guidelines for resolving ethical issues in a professional manner.**

The GEP provides a structured approach to resolving ethical issues in a professional manner.

(a) Identify the Ethical Issue/Recognize the Problem

Clearly identify and understand the ethical dilemma. This involves recognizing situations where professional conduct may be compromised or where there is a conflict of interest.

(b) Consult the Code of Ethics for Geodetic Engineers

Reviewing these standards can provide guidance on how to handle specific ethical issues.

(c) Seek Advice and Consultation with Peers

Discuss the issue with colleagues or mentors who can provide an objective perspective. This can help in evaluating the situation and exploring possible solutions. If necessary, seek advice from other professional bodies who can offer guidance and support in resolving complex ethical dilemmas.

(d) Evaluate Alternatives/Consider Consequences

Evaluate the potential outcomes of different courses of action. Consider how each alternative affects stakeholders, including clients, colleagues, and the public. Use ethical reasoning to weigh the rights and obligations of all parties involved and consider principles such as fairness, integrity, and respect for the law.

(e) Make an Informed Decision

Based on the evaluation, make a decision that aligns with ethical standards and professional responsibilities and ensure that the decision is well-documented and justified. Communicate the decision transparently to all relevant parties, explaining the rationale behind it.

(f) Action Plan/Implement and Monitor

Implement the chosen course of action and monitor its impact. Ensure that the implementation is consistent with the ethical guidelines and professional standards. Regularly review the situation to ensure that the ethical issue has been resolved and that no new issues have arisen.

(g) Report and Document

Keep detailed records of the ethical issue, the decision-making process, and the actions taken. This documentation can be useful for future reference and accountability. If the issue involves serious ethical violations, report it to the appropriate authorities, the PRBGE.

By following these guidelines, geodetic engineers can navigate ethical dilemmas professionally and uphold the integrity of their practice.

Section 13: Support and Resources

1. Technical Support: (Under process)

- **Contact information for technical support and assistance.**
- **Online resources and help desks.**

Annex 1 – Section 11, CMO No. 89, Series of 2017, Policies, Standards and Guidelines for Bachelor of Science in Geodetic Engineering

Section 11 Sample Curriculum

11.1 Components

Classification/ Field / Course	Minimum No. of Hours Lecture/Lab		Minimum Credit Units
	Lecture	Lab	
I. TECHNICAL COURSES			
A. Mathematics and Physical Sciences			
Calculus 1	3	0	3
Calculus 2	3	0	3
Engineering Data Analysis	3	0	3
Differential Equations	3	0	3
Physics for Engineers	3	3	4
Sub-Total	15	3	16
B. Basic Engineering Sciences			
Computer Fundamentals & Programming	1	6	3
Computer-Aided Drafting	1	3	2
Engineering Mechanics	3	0	3
Engineering Economics	3	0	3
Engineering Management	3	0	3
Safety Management	1	0	1
Technopreneurship 101	3	0	3
Sub-Total	15	9	18

Classification/ Field / Course	Minimum No. of Hours Lecture/Lab		Minimum Credit Units
	Lecture	Lab	
C. Allied Courses			
Principles of Geology	3	0	3
Electrical and Electronics Engineering for Geodetic Engineers	3	0	3
Advanced Information & Communications Technology	3	0	3
Environmental Science and Engineering	3	0	3
Sub-Total	12	0	12

D. Professional Courses			
General Surveying 1	2	3	3
General Surveying 2	2	6	4
Property Surveys	3	6	5
Engineering Surveys	2	6	4
Cartography	1	6	3
Introduction to the Laws on Private and Public Lands	2	0	2
Geodetic Engineering Laws, Obligations and Contracts, Ethics	2	0	2
Public Land Laws & Laws on Natural Resources	3	0	3
Land Registration Laws	3	0	3
Photogrammetry	2	6	4
Remote Sensing	2	6	4
Geometric Geodesy	3	0	3
Physical Geodesy	3	0	3
Satellite Geodesy	3	0	3
Geodetic Surveying	2	6	4
Hydrographic Surveying	2	3	3
Theory of Errors and Adjustments	3	0	3
Geodetic Computations & Adjustments	2	6	4
Land Use Planning and Development	2	3	3

Land Administration and Management	3	0	3
Geographic Information Systems	1	6	3
Geodetic Engineering Elective	3	0	3
Survey Camp	0	3	1
Geodetic Engineering Immersion/OJT	0	240	2
Methods of Research	1	0	1
Special Studies in Geodetic Engineering	1	6	3
Sub-Total	53	312	79
TOTAL TECHNICAL COURSES	95	324	125

II. NON-TECHNICAL COURSES			
A. Required General Education			
Understanding the Self	3	0	3
Readings in Philippine History	3	0	3
The Contemporary World	3	0	3
Mathematics in the Modern World	3	0	3
Purposive Communication	3	0	3
Ethics	3	0	3
Art Appreciation	3	0	3
Science, Technology, and Society	3	0	3
Sub-Total	24	0	24
B. General Education Electives			
General Education Elective	3	0	3
General Education Elective	3	0	3
General Education Elective	3	0	3
Sub-Total	9	0	9

Classification/ Field / Course	Minimum No. of Hours Lecture/Lab		Minimum Credit Units
	Lecture	Lab	
C. Mandated Courses			
Life and Works of Rizal	3	0	3
Sub-Total	3	0	3
D. Physical Education			
P.E. 1			2
P.E. 2			2
P.E. 3			2
P.E. 4			2
Sub-Total			8
E. National Service Training Program			
N.S.T.P. 1			3
N.S.T.P. 2			3
Sub-Total			6
TOTAL NON-TECHNICAL COURSES			50
GRAND TOTAL			175

SUMMARY OF THE BSGE CURRICULUM

Classification/ Field	Total No. of Hours		Total No. of Units
	Lecture	Laboratory	
I. TECHNICAL COURSES			
A. Mathematics and Physical Sciences	15	3	16
B.. Basic Engineering Sciences	15	9	18
C. Allied Courses	12	0	12
D. Professional Courses	53	312	79
Sub- Total	95	324	125

II. NON-TECHNICAL COURSES			
A. Required General Education Courses	24	0	24
B. General Education Electives	9	0	9
C. Mandated Course	3	0	0
D. Physical Education			6
E. National Service Training Program			8
Sub-Total	36		50
GRAND TOTAL			175