Revision of B.E. Geomatic Engineering Curriculum

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ABSTRACT

Keywords: Curriculum, Geomatic Engineering, Subject Committee, Dean's Office, Purbanchal University.

The technology of Geomatic Engineering is changing rapidly due to advances in precision instruments, programming and software applications, evolving user requirements, sustainable earth development practices, and rapid progress in aerial and satellite imagery. Technologies such as UAVs integrated with digital twins, artificial intelligence (AI), quantum computation, cloud storage, and Global Navigation Satellite Systems (GNSS) are developing at an unprecedented pace. Miniaturized instruments and sensors are increasingly being used in satellite systems and modern surveying equipment.

It has therefore become essential to incorporate these technological advancements into the academic curriculum. Curriculum revision is generally carried out through the collection and analysis of new technological information, existing professional practices, current curricula, and curricula of neighboring countries with comparable technological environments.

A draft curriculum is prepared by subject experts and presented to the expert committee in the presence of the Dean of the Faculty. After endorsement by the Subject Committee Chairperson, the curriculum is submitted to the Purbanchal University Senate for approval. Through this systematic process, the curriculum is revised to ensure that graduating students possess up-to-date knowledge and skills required by modern industry and academia.

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2. BACKGROUND

The B.E. Geomatic Engineering curriculum was originally developed in 2004, based on the requirements of government agencies and the private sector at that time. Since then, technological advancements have been enormous. Traditional manual systems—such as the use of pencils, paper, scales, and conventional instruments—have largely been phased out. Instruments like total stations have replaced theodolites, and new control networks are being extended using GNSS technologies, particularly RTK and PPP observations.

Conventional photography has been replaced by aerial, satellite, and UAV imagery. Height determination is now commonly carried out using GNSS RTK, LiDAR, and aerial imaging techniques. Hydrographic surveys are increasingly performed using green LiDAR imaging.

The earlier curriculum comprised approximately 180 credit hours, which required reduction to about 150 credit hours. This reduction was achieved by optimizing fieldwork components, removing outdated courses, and introducing modern subjects relevant to current technological demands.

As with any professional program, periodic curriculum revision is essential to train students in emerging technologies such as AI, sensor fusion, and scanning technologies. New interdisciplinary subjects such as rural and urban planning and engineering construction management have also been introduced.

3. NEED FOR REVISION OF THE CURRICULUM

The curriculum needed revision primarily to align student training with modern technologies. Additionally, changes in evaluation and marking systems adopted by other universities and the Public Service Commission required harmonization. These institutions no longer follow a uniform marking scheme for all questions.

To address this, the examination pattern was revised to include very short, short, and long questions, with marks allocated chapter-wise rather than equally to all chapters. Lecturers are

now responsible for internal evaluation amounting to 40–50% of the total marks, providing greater academic autonomy and flexibility in assessing student performance.

The primary drivers for curriculum revision were rapid technological changes, advancements in instrumentation, and widespread digitalization of geomatics practices.

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4. COURSE CHANGES

The earlier curriculum consisted of 64 papers totaling approximately 180 credit hours. This was reduced to a maximum of 150 credit hours. For this purpose, existing B.E. Geomatics curricula of Nepal (Kathmandu University, Purbanchal University, and Tribhuvan University) and Sri Lanka were studied.

A committee formed under the Dean of the Faculty of Engineering reviewed these curricula and finalized a revised structure for the B.E. Geomatic Engineering program of Purbanchal University (PU). Both the old and revised curricula are provided in **Appendix A-1** and **Appendix A-2**

The college prepared detailed syllabi based on subjects approved by the Dean, Subject Committee Chairs, and experts from Civil and Geomatic Engineering disciplines. These syllabi were presented to the university and faculty representatives, who provided detailed feedback on geomatics, mathematics, chemistry, physics, computer science, electrical, and electronics subjects.

Seminar outcomes included decisions to incorporate modern subjects, finalize curricula for each paper, limit excessive flexibility in course contents, and remove lecturer-specific notes from the curriculum framework. Marks allocation for practical work, office work, and fieldwork, along with assessment methods, were finalized and are presented in **Appendix B**.

The grading system adopted is AGREE, based on the cumulative grade point average of all eight semesters, as detailed in **Appendix C**.

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5. FINALIZATION OF THE COURSE

The Subject Committee finalized a uniform format for curriculum presentation, including font size, course objectives, detailed contents, reference books, exercises, chapter-wise marks distribution, and model equations. Course descriptions were prepared accordingly.

New and potential courses, including AI and other emerging subjects, were proposed. Course lecturers prepared detailed syllabi for these subjects and submitted them to the college and Principal. The college then presented the complete curriculum to Purbanchal University.

Several committee meetings were held in Kathmandu, including two-day residential workshops organized by Purbanchal University for finalization of the curriculum. Multiple online meetings were also conducted to finalize remaining subjects. Ultimately, the curriculum for all engineering programs was approved by the Subject Committee and the University Senate, and implementation began on a semester basis.

During the finalization meeting held at Kabilas, Chitwan, a two-month internship was added to the eighth semester. Consultations were conducted with private surveying industries. Although the Survey Department—the national mapping organization—does not traditionally offer internship placements, 10–15 private survey industries agreed to provide internships, which was deemed sufficient for current student intake.

Historically, measuring rods made of bamboo or iron were replaced by invar, steel, or cloth tapes. Later, photon-based distance measurement using the speed of light became standard. However, for outer-space measurement and communication, even light-based systems are relatively slow, necessitating future exploration of faster particles and sensors capable of measuring cosmic phenomena within shorter time scales.

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6. CONCLUSION

The B.E. Geomatic Engineering curriculum was revised after nearly 20 years to incorporate modern subjects and emerging technologies. Several outdated subjects were shifted to higher levels of education, while essential manual surveying subjects were retained to provide foundational understanding.

Although flexibility for lecturers to modify course content was limited and the mathematical load remained relatively high, the revised curriculum represents a significant modernization. To remain relevant, the curriculum should ideally be reviewed and updated at least every five years to accommodate rapid technological advancements and new measurement paradigms.

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7. REFERENCES

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Appendix A.1

Subjects of the **Old B.E. Geomatic Engineering Course**

Semester 1

Subject Code	Subject	Credit Hours
BEG111GE	Fundamentals of Surveying	2
BEG113GE	Introduction to GIS	2
BEG105HS	Communicative English	2
BEG101HS	Mathematics I	3
BEG104HS	Chemistry	3
BEG114GE	Map Drafting and Design	2
BEG175CO	Computer Concepts and Programming	3
BEG179GE	Fieldwork I (Plane Surveying)	1
Total		**18**

Semester 2

Subject Code	Subject	Credit Hours
BEG112GE	Plane Surveying	2
BEG115GE	Computer Drafting and Design	1
BEG102HS	Mathematics II	3
BEG103HS	Physics	3
BEG123GE	Geodesy I – Geodetic Control	3
BEG116GE	Land Administration	2
BEG171GE	Topographical Surveying I	3
BEG188GE	Communicative Nepali	2
Total		**19**

Semester 3

Subject Code	Subject	Credit Hours
BEG221GE	Field Astronomy	3

Subject Code	Subject	Credit Hours
BEG249ME	Fundamentals of Thermodynamics and Heat	2
BEG251GE	Cadastral Surveying I	2
BEG253GE	Land Law	2
BEG201HS	Mathematics III	3
BEG231GE	Photogrammetry I	3
BEG241GE	Cartography I – Map Projections	3
BEG279GE	Fieldwork II – Geodetic Surveying	1
Total		**19**

Semester 4

Subject Code	Subject	Credit Hours
BEG224GE	Geodesy II – Gravity and GNSS	2
BEG235GE	Remote Sensing	2
BEG252GE	Cadastral Surveying II – Digital Cadastre	1
BEG254GE	Land Registration	2
BEG232GE	Photogrammetry II	2
BEG242GE	Cartography II	2
BEG287GE	Computer Programming	3
BEG257CI	Mathematics V – Probability and Statistics	3
BEG272GE	Topographical Surveying of Other Surfaces	2
Total		**19**

Semester 5

Subject Code	Subject	Credit Hours
BEG322GE	Astronomy	2
BEG325GE	Geodesy III – Satellite Geodesy	2
BEG333GE	Digital Photogrammetry I – Theoretical	3
BEG336GE	Digital Image Processing	3
BEG343GE	Digital Cartography I – Theoretical	2
BEG345GE	Map Reproduction Technology	2
BEG375CO	Mathematics IV – Numerical Methods	3
BEG379GE	Fieldwork III (Topographical & Cadastral Surveying)	1

Subject Code	Subject	Credit Hours
Total		**18**

Semester 6

Subject Code	Subject	Credit Hours
BEG376GE	Environmental Survey and Mapping	2
BEG326GE	Geodesy IV – Physical Geodesy	2
BEG327GE	Geomatic Computation I – Survey Adjustment	2
BEG334GE	Digital Photogrammetry II – Observational	2
BEG378GE	Socio-economic Survey	2
BEG344GE	Digital Cartography II – Digital & Web Mapping	2
BEG396MS	Research Methodology	2
BEG389GE	Geological Survey	2
Total		**16**

Semester 7

Subject Code	Subject	Credit Hours
BEG494MS	Project Management	3
BEG474GE	Engineering Survey	2
BEG461GE	Land Valuation I – Introduction	2
BEG446GE	GIS I	2
BEG463GE	Land Reform and Management	2
BEG428GE	Geomatic Computation II – Survey Software	1
BEG479GE	Project Fieldwork	1
Elective (One)		**3**
Total		**16**

Elective Subjects

- BEG448GE: Geographical Data Infrastructure and Web Mapping
- BEG429GE: Gravity, GNSS, and Inertial Positioning
- BEG465GE: Quantity Surveying
- BEG455GE: Land Information System
- BEG464GE: Urban and Regional Planning

Semester 8

Subject Code	Subject	Credit Hours
BEG484GE	Professional Practice and Ethics	2
BEG473GE	Land Resource Mapping	2
BEG475GE	Engineering Survey II – Project Survey	2
BEG462GE	Land Valuation II	2
BEG447GE	GIS II – Development and Implementation	2
BEG477GE	Land / Earth Observation System	3
BEG481GE	Project / Thesis Work	3
Total		**16**

Grand Total (8 Semesters): 141 Credit Hours

Fieldwork Period: January–February (3–4 weeks)

Appendix A.2

Subjects of the **New B.E. Geomatic Engineering Course**

(Details provided in revised curriculum document) **and**

Appendix B

Percentage of Internal Assessment – B.E. Geomatic Engineering**

(As per approved Purbanchal university assessment policy)

Course Structure of Bachelor in Geomatic Engineering
(Effective from 2021 Batch)First Semester

Course Code	Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)
BSH1001	Mathematics I	3	3	3	-

BSH1002	English for Technical Communication	3	3	2	2
BSH1003	Chemistry	3	3	2	2
BGE1001	Basic GIS	3	3	-	3
BGE1002	Fundamentals of Surveying	3	1	1	3
BGE1003	Field Work I	3	1	-	3

Second Semester

Course Code	Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)
BSH2005	Mathematics II	3	3	3	-
BSH2004	Physics	4	4	2	2
BGE2004	Geodesy	3	3	1	1
BSH2007	Communicative Nepali	3	3	1	1
BCE2001	Computer Programming	3	3	1	3
BEL2002	Fundamental of Electrical & Electronics	3	3	-	2

Third Semester

Course Code	Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)
BSH3008	Mathematics III	3	3	3	-
BGE3005	Photogrammetry	3	3	1	2/2
BGE3006	Cadastral Surveying	3	3	-	2/2
BGE3007	Cartography & Map Reproduction	3	3	-	2/2
BGE3008	Topographic Surveying I	3	3	1	2/2
BGE3009	Field Work II	3	1	-	5

Fourth Semester

Course Code	Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)
BSH4001	Probability & Statistics	3	3	2	2

BME4009	Fundamentals of Thermodynamics	2	2	1	2/2
BCE4014	Remote Sensing & Image Processing	3	3	-	2/2
BGE4010	Land Registration & Administration	3	3	-	2/2
BGE4012	Engineering Survey	3	3	2	2/2
BGE4011	Astronomy	3	3	1	2/2

Semester V

Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)	Total
Digital Photogrammetry	3	3	-	2/2	3
Physical Geodesy	3	3	-	2/2	3
Mathematics V (Numerical Methods)	3	3	-	-	3
Advanced GIS & Database Management System	3	3	2	2/2	6
Digital Cartography	3	3	-	2/2	4
Field Work III	3	3	-	5	6
TOTAL	18	18	2	10	25

Semester VI

Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)	Total
Geomatic Computation	3	3	2	-	5
Land Resource Mapping	3	3	-	2/2	4
Spatial Data Modelling & Infrastructure	3	3	-	2/2	4
Land Law	3	3	-	2/2	4
Satellite Geodesy	3	3	1	2/2	5

Advanced Computer Programming	3	3	3	-	6
Digital & 3D Cadastre	3	3	-	2/2	4
TOTAL	18	18	6	5	32

Semester VII

Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)	Total
Survey Project Management	3	3	-	-	3
Professional Ethics & Practice	3	3	-	-	3
Environmental & Socio-economic Survey	3	3	-	-	3
Land Valuation	3	3	-	2/2	4
Estimating & Costing	3	3	3	-	6
Field Work IV	3	3	-	3	6

Semester VIII

Subject	Credit Hours	Lecture (L)	Tutorial (T)	Practical (P)	Total
Engineering Economics & Management	3	3	-	-	3
Spatial Planning & Development	3	3	-	2/2	4
Elective	3	3	-	-	3
Project Work	3	3	-	-	3
Internship	3	3	-	-	4
TOTAL	15	15	-	1	17

Note: L = Lecture, T = Tutorial, P = Practical. Figures are presented in a print-ready academic format.

Elective Subjects (Semester VIII)

- GIS Application for Disaster Risk Management (DRM)
- Earth Observation
- Urban and Regional Planning

Note: C.H. = Credit Hour, L = Lecture, T = Tutorial, P = Practical, Th = Theory

Appendix C

Grading System – B.E. Geomatic Engineering**

(AGREE grading system as approved by the Purbanchal University Senate)

LETTER GRADING SYSTEM

EQUIVALENT MARKS	LETTER GRADES	GRADE VALUE	REMARKS
90 and Above	A+	4.00	
80 and Below 90	A	3.75	
70 and Below 80	B+	3.50	
60 and Below 70	B	3.00	
50 and Below 60	C	2.50	
40 and Below 50	D	1.75	
Below 40	F	0.00	Fail
Not Qualified (NQ) Absent	I	-	Incomplete

CGPA (Cumulative Grade Point Average) at the end of the degree defines the division which will be one of the followings:

CGPA Definition	Division
3.75 and Below 4.00	First with Excellence
3.50 and Below 3.75	First with Distinction
3.00 and Below 3.50	First Division
2.50 and Below 3.00	Second Division
2.00 and Below2.50	Pass Division

The CGPA of students must remain 2.00 or above throughout the duration of studies. A students who has not obtained the minimum CGPA by the completion of all semester exam shall be allowed to take betterment Examination have lowest grade i.e. 'C' Grade according to proposed grading system to improve grade to make up the minimum CGPA. The student will be allowed to sit for betterment exam

after completion of all semester exams, according to the betterment examination application submitted by student and approval from the Office of the Examination Management.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

CGPA is calculated at the end of the programme. The overall performance is reported by CGPA, which is a weighted average, calculated as follows.

$CGPA=(c_1g_1+c_2g_2+c_2g_3+....)(c_1+c_2+c_3....)$

Where c_1,c_2,c_3..Denote credits associated with the course and g1, g2, g3...Dente grade values of the grade earned by the student in the respective course.