Subject Description Form

Subject Code	LSGI2341A
Subject Title	**Survey Adjustment**
Credit Value	3
Level	2
Pre-requisites	AMA1110 Basic Mathematics I – Calculus and Probability & Statistics; and AMA1120 Basic Mathematics II – Calculus and Linear Algebra
Objectives	The objectives of this subject are 1. To provide an understanding of the basic statistical concepts relevant to the analysis of observations 2. To be skilful on basic survey adjustment method 3. To train students' problem-solving skills through hybrid problem-based learning
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Explain the basic statistical concepts relevant to the analysis of observations (L2) 2. Identify the error sources affecting survey measurements (L2) 3. Differentiate appropriate adjustment models for different surveying techniques (L3) 4. Assess the quality of observations (L2 and L3)
Subject Synopsis/ Indicative Syllabus	**A Observation Errors and their Propagation** Types of observation errors, variance and covariance; correlation; variance-covariance matrix; variance of a quantity derived from observations for linear, non-linear functions; covariance of two quantities derived from same set of observations; weight, weight matrix and weighted mean. **B Concept o Least Squares Adjustment** Concept of least squares, observation equations, linearization of observation equations, least squares solutions. **C Analysis of Least Squares Results** Statistical test of least squares results, detection of outliers, variance component estimation. **D Introduction to the Design of Survey Schemes**

<table>
<tr><td>Teaching/Learning Methodology</td><td>Students are briefly lectured about observation errors and the survey adjustment methods followed by appropriate sample solutions for various generic adjustment problems.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="4">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>1. Assignment</td><td>20</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Test</td><td>30</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>3. Examination</td><td>50</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="4"></td></tr>
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Student must pass continuous assessment and final examination in order to pass the subject.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Continuous assessment consists of two components, phase test and practical work. A phase test will be given to assess students' basic understanding of statistical concepts related to the analysis of observation and the surveying adjustment methods.
Two assignments will be used to assess students' appreciation of adjustment theory and how to use it to solve surveying problems. The first assignment will be organised into two components, with the first part dedicated to solutions of numerical problems in the surveying adjustment. The second part will involve the use and application of Gen-AI in the learning process of students related to design and optimalization of survey configuration and observation by using AI tools. In the second assignment the StarNet software is used to adjust levelling and polygon network. The Gen-AI will be incorporated in this assignment to propose the optimalization of the survey configuration and measurement.
A written examination will test students' independent skills of expression, as well as knowledge of adjustment methods and apply them to solve surveying problems.
Students need to pass both continuous assessment and examination in order to pass the whole subject.

Generative AI can only serve as a tool for assisting initial idea development and proofreading for project presentation and report, and any involvement of generative AI tools must be clearly acknowledged and referenced. Students are required to make close link between the</td></tr>
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	subject contents and the proposed case-specific scenario to encourage critical thinking.	
Student Study Effort Expected	Class contact:	
	▪ Lectures	26 Hrs.
	▪ Tutorial – doing exercises in class	13 Hrs.
	▪ Self-study, reading and revision; assignment	66 Hrs.
	Total student study effort	105 Hrs.
Reading List and References	<u>References</u> 1. Wolf, P.R. and C.D. Ghilani (1997). *Adjustment computations*. John Wiley and Sons, Inc., N.Y 2. Mikhail, E.M., and G. Gracie (1981). *Analysis and adjustment of survey measurements*. Van Nostrand Reinhold, NY. 3. Mikhail, E.M. (1976). *Observations and least squares*. University Press of America, N.Y. 4. Uotila, U (1988) Analysis of Observations. Lecture Notes, The Ohio State University. <u>Reading List</u> 1. Graybill F.A. (1984).Theory and Application of the Linear Model, Duxbury Press. 2. Hamilton, W.C. (11964) Statistics in Physical Science, Ronald Press Pub Comp.	