Subject Description Form

Subject Code	LSGI3315
Subject Title	**GIS Engineering**
Credit Value	3
Level	3
Pre-requisites	LSGI2223 Geographic Information Science; and COMP1011 Programming Fundamentals or COMP1012 Programming Fundamentals and Applications
Objectives	The subject covers the design and development of GIS applications within a GIS project. Its purpose is to provide awareness in software development and system customisation in small to medium sized Geomatics project. During practical works and projects, students will spend significant efforts in programming and will acquire experience in object-oriented programming. The presentation and technical report requirements for group projects will help students developing their communication skills.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Understand the concept of objected-oriented programming and implement it through a particular programming language (L3) 2. Carry out customisation of a GIS system for a specific client or purpose (L3) 3. Develop a GIS application by selecting appropriate software and components (L3)

Subject Synopsis/ Indicative Syllabus	**System customisation (70%)**
	      Object oriented programming
	      Python, Arcpy, and geoprocessing
	      Python Add-in and integration with ArcGIS Desktop
	System development (30%)
	      Object-oriented analysis
	      Object-oriented design
	      Introduction to composable GISystems and open-source GISystems

Teaching/Learning Methodology	In the first part of the course, major concepts of object-oriented programming (OOP) will be presented. The lectures will introduce Python as a high-level programming language and offer guidelines on the implementation of core OOP concepts (e.g., class, attributes, methods). The second part of the course will focus on the integration of OOP and particular GIS tasks (e.g., geoprocessing). Arcpy, a Python package that provides rich capabilities of geographic data analysis and management, will be introduced. The lectures will focus on the implementation of data conversion and geoprocessing tasks using Arcpy. The third part of the course will focus on GIS system development and customization. Python Add-In, a toolkit provided by ArcGIS platform, will be

introduced. The courses will focus on the usage of Python Add-In for GUI design, implementation of GIS tasks, and the integration with ArcGIS desktop applications (e.g., ArcMap).

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
			1	2	3	
	1. Assignment – Object oriented programming	30%		✓		
	2. Assignment – OOP and Geoprocessing Tasks	25%	✓			
	3. Group project	45%	✓	✓	✓	
	Total	100 %				

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

Assignments are used to assess if the students understand and are able to use the concepts presented in the lectures and applied in practical sessions. Students will have to submit small reports including either a UML diagram or a program they developed. The group project will assess their overall mastery of the subject. Students will have to design and develop a GIS application. The project will occupy the second half of the course and the students' work and progress will be assessed in intermediate reports and in a final presentation.

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 subject contents and the proposed case-specific scenario to encourage critical thinking.

Student Study Effort Expected	Class contact:	
	▪ Lectures	13 Hrs.
	▪ Practical sessions	26 Hrs.
	Other student study effort:	
	▪ Preparation	20 Hrs.
	▪ Project and assignments	50 Hrs.
	Total student study effort	109 Hrs.

Reading List and References	D Phillips, "Python 3 objected-oriented programming", Packt Publishing Ltd, 2015 (E-book available through PolyU *OneSearch*)
	Introduction to ArcPy, online resources available at http://pro.arcgis.com/en/pro-app/arcpy/get-started/what-is-arcpy-.htm
	Python Add-In Wizard, online resources available at https://www.arcgis.com/home/item.html?id=5f3aefe77f6b4f61ad3e4c62f30bff3b
	G. B. Hall and M. G. Leahy (eds), "*Open Source Approaches in Spatial Data Handling*", Springer, 2008
	C. Parent, S. Spaccapietra, E. Zimányi, "*Conceptual Modeling for Traditional and Spatio-Temporal Applications*", Springer, 2006
	P. Rigaux, M. Scholl, A. Voisard, "*Spatial Databases with application to GIS*", Morgan Kaufmann, 2002, PolyU call number G70.212.R54 2002.
	M. F. Worboys and M. Duckham, "*GIS, a Computer Perspective*", Second edition, CRC Press, 2004, PolyU call number G70.2.W66 2004.
	M. F. Worboys and M. Duckham, "*GIS, a Computer Perspective*", online resources available at http://worboys.duckham.org