Subject Description Form

Subject Code	LSGI3652A
Subject Title	**Utility Systems and Design**
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objectives of this subject are: • To provide a broad understanding of the fundamental system and design of engineering geology, geotechnics and soil mechanics for utility surveyors. • To enable students bridge utility surveying activities and environmental issues of utility design processes through practice in Building Information Modelling (BIM). • To enable students to understand the role of utility surveyors and engineers in utility systems and design.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Describe proper site selection, routing and alignment for utility design (L2). 2. Identify proper sites for utility facilities in relation to urban geology, geotechnics and soil mechanics (L2). 3. Identify geology and soil types that may lead to utility system failures (L3). 4. Design utility systems, pipeline hydraulics, pipe materials design considerations and Hong Kong Government and industry standards in Building Information Management (BIM) environment (L3).
Subject Synopsis/ Indicative Syllabus	**A. Soil and rock classification and physical properties** Soil and rock classification, engineering aspects of igneous and metamorphic rocks, physical properties and engineering behavior of soil. **B. Pipe Design and Materials** External earth load, design of rigid and flexible pipe, design of gravity and pressurized pipe, material types and characteristics, pipe and soil interaction, considerations of pipe selection, corrosion protection **C. Groundwater Conditions and Supply** The origin and occurrence of groundwater, capillary movement in soil, porosity and permeability, flow through soils and rocks, pore pressures, assessment of field permeability, assessment of flow in the field. **D. Site investigation for Underground Utility Locations** Methods of investigation, sampling, borehole logs, geophysical methods.

E. Utility Systems (water supplies, drainage and sewer)
Design of utility system (1) Properties of liquid and gas, pipeline hydraulic analysis, (2) route selection, utility networks, alignment sheet, valve stations in BIM environment

Teaching/Learning Methodology

Lecture	Tutorial/ practical	Experiment	Field survey	Guest lecture	Site visit	On-line learning
✓	✓	✓		✓		

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	4
1. Mid-term test	20	✓	✓	✓	✓
2. Design Project	30	✓	✓	✓	✓
3. Examination	50	✓	✓	✓	✓
Total	100 %				

For design project, students are required to make use of BIM to design one of utility systems, i.e. water supplies, drainage and sewer, in a case-specific scenario in Hong Kong. Students are required to make close link between the general principles of utility system design and the proposed case-specific scenario to encourage critical thinking and avoid excessive reliance on Generative AI.

Student Study Effort Expected

Class contact:	
▪ Lectures	26 Hrs.
▪ Tutorial/practical	26 Hrs.
Other student study effort:	
▪ Self-study, reading and revision	60 Hrs.
Total student study effort	112 Hrs.

Reading List and References

1. E. Shashi Menon (2011), *Pipeline planning and construction field manual*.
2. A.P. Moser and S. Folkman (2008), *Buried pipe design*, 3rd McGraw Hill.
3. BS 5930: 1999 + A2: (2010) *Code of practice for site investigation*.
4. H. Mohitpour, and M. Golshan (2007). *Pipeline Design & Construction: a Practical Approach*, 3rd ed. New York: ASME Press.

	5. J.A. Knappett and R. F. Craig (2012) *Craig's Soil Mechanics*, 8th Edition, Spon Press. 6. P.M. Cashman and M. Preene (2003). *Groundwater Lowering in Construction : A Practical Guide*, Spon Press 7. Prabhata K. Swamee and Ashok K. Sharma (2008) , *Design of Water Supply Pipe Networks*, John, Wiley & Sons. 8. Satoshi Takizawa (Ed.) (2008), *Groundwater management in Asian cities: technology and policy for sustainability*. 9. Fred G. Bell. (2000) *Engineering properties of soils and rocks*. 10. ISO 19650 | BSI Hong Kong - BSI Group, https://www.bsigroup.com/en-HK/ 11. *The BIM management handbook*, Shepherd David, Newcastle upon Tyne : RIBA Publishing 2015, ISBN: 9780429347535 12. *BIM-Based Collaborative Building Process Management*, Daniotti Bruno; Pavan Alberto; Lupica Spagnolo Sonia; Caffi Vittorio; Pasini Daniela; Mirarchi Claudio, Cham: Springer International Publishing AG 2019, ISBN: 9783030328887 13. *BIM and Construction Management: Proven Tools, Methods, and Workflows*, Hardin Brad; McCool Dave, New York: John Wiley &Sons, Incorporated 2015, ISBN: 9781118942765 14. *BIM for Facility Managers, IFMA; Teicholz Paul, New York: Wiley 2013, ISBN: 9781118382813* 15. Construction Industry Council. (2021). *CIC BIM Standards for Underground Utilities (Version 2 – 2021)* 16. Construction Industry Council. (2021). *CIC BIM Dictionary 2021* 17. Construction Industry Council. (2020). *CIC BIM Standards - General (Version 2 - December 2020)*