Subject Description Form

Subject Code	LSGI3614
Subject Title	**Geophysical Survey of Utilities**
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objectives of this subject are: • To provide an understanding of the fundamental principles and geophysical techniques of utility surveying. • To enable students become proficient in the use of conventional and modern geophysical survey equipment. • To ensure the proper application of principles and methods when carrying out geophysical surveying tasks. Students' communication skill, leadership and cooperative attitudes of work with others will be developed through laboratory experiments and group field practical.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Understand the wave properties in materials (L2) 2. Describe the functions and operation of the geophysical surveying instrument (L2) 3. Interpret the surveying results (L3) 4. Compare different geophysical surveying technologies, and understand their limitations (L3) 5. Confidently carry out utility surveying project (L2)
Subject Synopsis/ Indicative Syllabus	**A. Wave Properties electromagnetic (EM) induction and thermo-dynamics in Geophysical Survey** Wave properties and EM induction in different types of pipes and mediums, methods for emitting and receiving electromagnetic, acoustic and seismic waves. Basic thermo-dynamics of heat transfer **B. Electromagnetic geophysical/nondesctructive survey techniques** Principles and operations applications of electromagnetic pipe cable locator ground penetrating radar (GPR) and infrared thermography, interpretation of radar and thermo-images, strength and limitation of the techniques. **C. Acoustic and seismic geophysical/non-destructive survey techniques** Principles and operations of passive and active acoustic methods, such as noise logging and leak noise correlation, seismic methods.

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<tr><td></td><td>D. Basic signal and image processing in Utility Surveying and Monitoring
Principles and practical hands-on analysis of electromagnetic, thermographic and acoustic signals.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>
<table>
<tr><td>Lecture</td><td>Tutorial/ practical</td><td>Experiment</td><td>Field survey</td><td>Guest lecture</td><td>Site visit</td><td>On-line learning</td></tr>
<tr><td>√</td><td>√</td><td>√</td><td>√</td><td></td><td>√</td><td></td></tr>
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</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="5">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><td>5</td></tr>
<tr><td>1. Mid-term multiple choice test</td><td>10</td><td>√</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>2. Hands-on practical test</td><td>20</td><td></td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>3. Group survey project</td><td>20</td><td></td><td></td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>4. Written Examination</td><td>50</td><td>√</td><td>√</td><td>√</td><td>√</td><td></td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="5"></td></tr>
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Mid-term tests and group survey project will be arranged to assess the ability of understanding of principles of geophysical surveying.
Hands-on practical test will be carried out in to test the ability of operating the equipment and analytical skills of the results.
For group survey project, students are required to survey a designated underground area, apply the survey principles in the survey area to encourage critical thinking and avoid excessive reliance on Generative AI during reporting.

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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lectures/site visits</td><td>26 Hrs.</td></tr>
<tr><td>▪ Tutorial/practical</td><td>26 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study, reading and revision</td><td>60 Hrs.</td></tr>
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	Total student study effort	112 Hrs.
Reading List and References	1. H. Jeong, C. Arboleda, D. Abraham, D. Halpin, L. Bernold (2003), *Imaging and Locating Buried Utilities*, Report no. FHWA/IN/JTRP-2003/12 Purdue University. 2. Mark E. Everett (2013) *Near-surface applied geophysics*, Cambridge University Press. 3. Harry M. Jol (Ed.) (2009) *Ground Penetrating Radar: Theory and Applications*, Elsevier B.V. 4. K. J. Sandmeier (2011). *GPR processing software Reflexw Manual for Reflexw 6.0*. 5. Mahesh L. Chugani, Abhay R. Samant, Michael Cerna (1998). *LabVIEW signal processing*, Upper Saddle River, NJ: Prentice Hall PTR. 6. Christopher Reed, Alastair J. Robinson, and David Smart (2004) *Techniques for monitoring structural behaviour of pipeline systems*, Denver, CO : Awwa Research Foundation : American Water Works Association. 7. Radiodetection Ltd. (2008) *abc & xyz of locating buried pipes and cables for the beginner and the specialist*. 8. 3M, (1998) *Cable and Pipe Locating Techniques for use with 3M™ Dynatel™ Cable and Pipe Locators*. 9. P.V. Xavier Maldague and O. M. Patrick (Ed.) (2001) *Infrared and thermal testing / technical editor, Columbus*, OH : American Society for Nondestructive Testing. 10. Department of Land Surveying and Geo-Informatics (LSGI) (2019), *Specifications 1,1 Pipe Cable Locating/Electromagnetic Locating*. 11. Department of Land Surveying and Geo-Informatics (LSGI) (2019) *Specification 1,2 Ground Penetrating Radar (GPR)*. 12. Department of Land Surveying and Geo-Informatics (LSGI) (2021) *Specification 1,3 Laser Scanning Survey (LiDAR)*.