Subject Description Form

Subject Code	LSGI536
Subject Title	Remote Sensing Image Processing
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Remote sensing is a modern technique for the rapid acquisition of data and information about the Earth's surface. This subject is to provide students with: principles and technology for remote sensing image acquisition, characteristics of remote sensing image data; methodology for geometric and radiometric processing of remote sensing images for quality improvement; techniques for interpreting information from remote sensing image data; principles of machine learning; and the applications of machine learning for remote sensing image processing and analysis.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. be familiar with the basic physical principles of remote sensing imaging; b. be familiar with common remote sensing platforms, sensors, and images; c. master practical skills in remote sensing image processing and analysis, including geometric and radiometric pre-processing, image enhancement, and image interpretation; d. discuss the various factors that influence the accuracy of information and features extracted from remote sensing images; e. acquire knowledge of machine learning algorithms; f. master how to apply machine learning for remote sensing image processing and analysis; g. design and implement research projects in the fields of remote sensing and machine learning;
Subject Synopsis/ Indicative Syllabus	• Acquisition of remote sensing image data: Principles and physical foundation of remote sensing imaging. • Characteristics of remote sensing image data. • Radiometric processing of remote sensing image data: Radiometric calibration, image enhancement, image filtering, etc. • Geometric processing of remote sensing image data: Geometric rectification, image registration, etc. • Thematic processing of remote sensing image data: Manual interpretation, automatic image classification, and change detection. • Applications of machine learning for remote sensing image processing and analysis: Water detection, land cover mapping, etc.

<table>
<tr><td>Teaching/Learning Methodology</td><td>

Lab exercises are used to reinforce the theories and methodologies introduced during the lectures and to enable students to gain practical problem-solving skills;
Group project reports and presentations are to enhance students' all-round development.

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<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="7">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a.</td><td>b.</td><td>c.</td><td>d.</td><td>e.</td><td>f.</td><td>g.</td></tr>
<tr><td>Continuous assessment</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Group project</td><td>40%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Final examination</td><td>30%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="7"></td></tr>
</table>
Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

Continuous assessment consists of two components, i.e., assignments and lab exercises. The assignments are linked and allow students to independently investigate a designated topic and present their findings, developing their critical thinking and professional presentation attributes. The lab exercises will consolidate students' basic understanding of concepts and methodologies learned and enhance their professional skills to solve actual problems in the field.
Group projects and presentations will reinforce and assess students' understanding of the image processing practice and skills gained during the course.
A written examination will test students' independent skills of expression, knowledge of the discipline, and ability to apply concepts and techniques to solve problems of land and environmental management in Hong Kong and other regions of the world.

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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Classes</td><td>39 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Assignments</td><td>20 Hrs.</td></tr>
<tr><td>▪ Group project</td><td>30 Hrs.</td></tr>
<tr><td>▪ Exam preparation</td><td>20 Hrs.</td></tr>
<tr><td>Total student study effort:</td><td>109 Hrs.</td></tr>
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Reading List and References	Journals and Conference Proceedings • Remote Sensing of Environment • ISPRS Journal of Photogrammetry and Remote Sensing • IEEE Transactions on Geoscience and Remote Sensing • International Journal of Applied Earth Observation and Geoinformation • GIScience & Remote Sensing • IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI) • IEEE Transactions on Image Processing (TIP) • Conference on Computer Vision and Pattern Recognition (CVPR) • European Conference on Computer Vision (ECCV) • International Conference on Computer Vision (ICCV) Books • Campbell, J. B., & Wynne, R. H., Thomas V. A. (2022). Introduction to Remote Sensing (6th Edition). Guilford Press. • Gonzalez, R. C. (2017). Digital Image Processing (4th Edition). Pearson. • Lillesand, T., Kiefer, R., Chipman, J. (2015), Remote Sensing and Image Interpretation (7th Edition). Wiley. • Schowengerdt, R. A. (2006). Remote Sensing: Models and Methods for Image Processing (3rd Edition). Elsevier. • Bishop, C. M., & Nasrabadi, N. M. (2006). Pattern Recognition and Machine Learning. Springer. • Alpaydin, E. (2020). Introduction to Machine Learning (4th Edition). MIT Press. • Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.