**The Hong Kong University of Science and Technology**

**UG Course Syllabus**

Geospatial Science & Technology for Smart City

CIVL4100U

3 Credits

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**Office Hours:** By email appointments

## Course Description

This course consists of lectures, in-class hands-on practices, readings, and a group project focused on geographical information science (GIS) and its application for smart city development. Lectures will cover basic concepts of location-based geospatial data for smart city development, Common Spatial Common Infrastructure (CSDI), GIS applications for city planning and monitoring, collection and handling of geospatial data, and geospatial analytics for smart city. Through hands-on practices, students will learn how to use different GIS technologies such as 3D GIS, Web GIS and mobile GIS for smart city planning, analysis, and management. Integration of GIS with other technologies will also be covered.

## Lecture Schedule

| Lecture | Date | Time | Topic |
|---|---|---|---|
| 1 | 03/09/2024 | 2:30-5:20pm | Introduction to GIS and Smart City |
| 2 | 10/09/2024 | 3-5:50pm | Fundamentals of Web and Mobile GIS (Lab Session) |
| 3 | 17/09/2024 | 3-5:50pm | Fundamental of GIS App (Lab Session) |
| 4 | 24/09/2024 | 3-5:50pm | Spatial Data Presentation and Visualization (Lab Session) |
| 5 | 05/10/2024 (Saturday) | 2 – 5pm | Spatial Data Infrastructure (SDI) and Open Geospatial Data (Site Visit to Geospatial Lab) |
| 6 | 08/10/2024 | 3-5:50pm | Spatial Data Analytics and GeoAI |
| 7 | 15/10/2024 | 3-5:50pm | Space Technologies, Satellite Imagery, and GIS |
| 8 | 22/10/2024 | 3-5:50pm | 3D GIS and Integration with BIM |
| 9 | 29/10/2024 | 3-5:50pm | GIS & Smart Mobility |
| 10 | 05/11/2024 | 2:30-5:20pm | Real Estate and Property Management Applications of GIS |
| 11 | 12/11/2024 | 3-5:50pm | Architecture, Engineering, and Construction (AEC) Applications of GIS |
| 12 | 19/11/2024 | 3-5:50pm | Smart City Planning and Design with GIS |
| 13 | 26/11/2024 | 2:30-5:20pm | Final Project Presentation |

**Intended Learning Outcomes (ILOs)**

By the end of this course, students should be able to:

ILO1: Define and understand the concepts of Smart Cities and recognize Smart City development directions of Hong Kong.
ILO2: Know the relationships and importance of using GIS in Smart Cities.
ILO3: Use GIS to build applications for the development of Smart Cities.
ILO4: Acquire GIS software operation skills and process GeoSpatial Open Data.
ILO5: Build GIS applications using GeoSpatial Cloud technology.

**Assessment and Grading**

**Summary Table**

| Assessment Task | Contribution to Overall Course grade (%) | Due date |
|---|---|---|
| First GIS Lab Exercise | 4% | 10/09/2024 |
| Second GIS Lab Exercise | 4% | 17/09/2024 |
| Third GIS Lab Exercise | 4% | 24/09/2024 |
| Fourth GIS Lab Exercise | 4% | 08/10/2024 |
| Fifth GIS Lab Exercise | 4% | 15/10/2024 |
| First Essay Assignment | 10% | 14/10/2024 |
| Second Essay Assignment | 10% | 05/11/2024 |
| Project Report | 30% | 19/11/2024 |
| Final Project Presentation | 20% | 26/11/2024 |
| Course Participation | 10% | Throughout the course |

**Mapping of Course ILOs to Assessment Tasks**

| Assessed Task | Mapped ILOs | Explanation |
|---|---|---|
| GIS Lab Exercises | IL03, IL04, IL05 | These exercises assess students' ability to catch up with GIS Lab Sessions that cover the skills to build GIS applications (IL03 and IL05), demonstrated their use of Geospatial Open Data (IL04). |
| Essay Assignments | IL01, IIL02 | These two essay assignments evaluate students' ability to truly understand the concept of Smart Cities (IL01) and to prove the importance of GIS in Smart Cities development with examples (IL02). |
| Final Project Presentation, Project Report | IL01, IL02,IL03, IL04, IL05 | These tasks allow students to put into practice what they have learned in the Geospatial Science and Technology for Smart Cities, demonstrating higher-order spatial literacy and skills of spatial analytics skills by identifying a real-world problem with geospatial solution(s). |
| Course Participation | IL01, IL02 | Participating in all classes will enable students to understand the concepts |

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| | | of Smart Cities (IL01) and the site visit to Geospatial Lab in particularly highlights the importance of Geospatial Open Data contribution to the Smart City development directions of Hong Kong (IL02). |

**Grading Rubrics**

**GIS Lab Exercises Rubrics:**

| Mapping to Course ILOs | Criteria | Excellent: Exemplary (A- to A+) | Good: Competent (B- to B+) | Satisfactory: Needs Work (C- to C+) | Marginal Pass (D) | Fail (F) |
|---|---|---|---|---|---|---|
| IL04 | GIS Tool and Technique Proficiency | Demonstrates exceptional proficiency in using GIS tools and techniques. | Demonstrates strong proficiency in using GIS tools and techniques. | Demonstrates basic proficiency in using GIS tools and techniques. | Demonstrates limited proficiency in using GIS tools and techniques. | Demonstrates little to no proficiency in using GIS tools and techniques. |
| IL03, IL04, IL05 | Accuracy and Completeness of Exercises | Completes all lab exercises with a high degree of accuracy and attention to detail. | Completes all lab exercises with a good degree of accuracy. | Completes most lab exercises with an acceptable level of accuracy. | Completes some lab exercises with errors or incomplete work. | Fails to complete multiple lab exercises or the work is unacceptable. |

**Essay Assignments Rubrics:**

| Mapping to Course ILOs | Criteria | Excellent: Exemplary (A- to A+) | Good: Competent (B- to B+) | Satisfactory: Needs Work (C- to C+) | Marginal Pass (D) | Fail (F) |
|---|---|---|---|---|---|---|
| IL01, IIL02 | Matching the Essay Topic | Essay is clearly and directly focused on the assigned topic throughout; demonstrates an in-depth understanding of the topic. | Essay is focused on the assigned topic for the most part; demonstrates a good understanding of the topic. | Essay is somewhat focused on the assigned topic, but may stray at times; demonstrates a basic understanding of the topic. | Essay is not consistently focused on the assigned topic; demonstrates limited understanding of the topic. | Essay is not focused on the assigned topic; demonstrates little to no understanding of the topic. |
| IL03 | Understanding of GIS/Geospatial Concepts | Essay demonstrates a comprehensive understanding of key GIS/geospatial concepts. | Essay shows a solid understanding of relevant GIS/geospatial concepts. | Essay exhibits a basic understanding of GIS/geospatial concepts. | Essay demonstrates a limited understanding of GIS/geospatial concepts. | Essay lacks understanding of GIS/geospatial concepts. |
| IL04, IL05 | Integration of GIS/Geospatial Data, Tools, and Technique | Effectively integrate a variety of relevant GIS/geospatial | Incorporate appropriate GIS/geospatial data, tools, and techniques to | Make some use of GIS/geospatial data, tools, and techniques, but | Make minimal use of GIS/geospatial data, tools, and techniques, and | Do not incorporate any GIS/geospatial data, tools, or |

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| | | data, tools, and techniques to support the analysis of smart city issues. | support the analysis of smart city issues. | the integration could be stronger. | lack substantive analysis. | techniques, and lack coherence. |

**Final Project Presentation & Project Report Rubrics:**

| Mapping to Course ILOs | Criteria | Excellent: Exemplary (A- to A+) | Good: Competent (B- to B+) | Satisfactory: Needs Work (C- to C+) | Marginal Pass (D) | Fail (F) |
|---|---|---|---|---|---|---|
| IL03, IL04, IL05 | Data Collection & Use of Open Data | Utilized a wide variety of highly relevant open data sources; data was seamlessly integrated into the project workflow. | Utilized several relevant open data sources; data was effectively integrated into the project workflow. | Used a limited number of open data sources; data was adequately integrated into the project workflow. | Used very few open data sources; data was not well-integrated into the project workflow. | Failed to utilize open data sources; data was not incorporated into the project. |
| IL04, IL05 | Spatial Analysis | Performed a wide range of highly appropriate spatial analysis; interpretation of spatial analysis results is insightful and impactful. | Performed several appropriate spatial analysis; interpretation of spatial analysis results is accurate and meaningful. | Performed a limited number of basic spatial analysis; interpretation of spatial analysis results is simplistic but reasonable. | Performed inappropriate or inadequate spatial analysis; interpretation of spatial analysis results is flawed or missing. | Failed to perform any meaningful spatial analysis; no interpretation of spatial analysis results provided. |
| IL03 | Application of GIS | Utilized a wide variety of highly relevant GIS tools and functionalities; exhibited mastery of GIS data creation, editing, and manipulation techniques. | Utilized several relevant GIS tools and functionalities; exhibited solid skills in GIS data creation, editing, and manipulation. | Utilized a limited number of basic GIS tools and functionalities; exhibited basic skills in GIS data creation, editing, and manipulation. | Utilized inappropriate or inadequate GIS tools and functionalities; exhibited poor skills in GIS data creation, editing, and manipulation. | Failed to utilize any relevant GIS tools and functionalities; exhibited no skills in GIS data creation, editing, and manipulation. |
| IL03, IL05 | Design of ArcGIS StoryMap | Visuals (maps, images, etc.) and interactive elements are of the highest quality and seamlessly support the narrative; overall design is highly aesthetically pleasing, accessible, and polished. | Visuals (maps, images, etc.) and interactive elements are high-quality and support the narrative well; overall design is aesthetically pleasing and accessible. | Visuals (maps, images, etc.) and interactive elements are adequate and somewhat support the narrative; overall design is reasonably pleasing and somewhat accessible. | Visuals (maps, images, etc.) and interactive elements are poor quality and do not support the narrative; overall design is unappealing and not accessible. | No visuals (maps, images, etc.) and interactive elements or they are completely irrelevant; overall design is unacceptable. |

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| IL01, IL02 | Presentation | Presentation is exceptionally well-organized, clear, and easy to follow; presenter(s) demonstrate mastery-level understanding of the project and findings. | Presentation is well-organized, clear, and easy to follow; presenter(s) demonstrate strong understanding of the project and findings. | Presentation is reasonably well-organized and somewhat clear; presenter(s) demonstrate basic understanding of the project and findings. | Presentation is poorly organized and unclear; presenter(s) demonstrate limited understanding of the project and findings. | Presentation is unorganized and incomprehensible; presenter(s) demonstrate no understanding of the project and findings. |

**Course Participation Rubrics:**

| **Mapping to Course ILOs** | **Criteria** | **Excellent: Exemplary (A- to A+)** | **Good: Competent (B- to B+)** | **Satisfactory: Needs Work (C- to C+)** | **Marginal Pass (D)** | **Fail (F)** |
|---|---|---|---|---|---|---|
| IL01, IL02 | Attendance and Participation | Consistently attends and actively participates in class discussions and activities. | Attends and participates regularly in class discussions and activities. | Attends class and participates occasionally in discussions and activities. | Attends class sporadically and rarely participates. | Frequently absent from class and does not participate. |
| IL01, IL02 | Engagement with Peers | Actively listens and provides thoughtful feedback to peers. | Provides constructive feedback to peers. | Provides limited feedback to peers. | Provides little to no feedback to peers. | Does not provide feedback to peers. |

**Final Grade Descriptors:**

[As appropriate to the course and aligned with university standards]

| **Grades** | **Short Description** | **Elaboration on subject grading description** |
|---|---|---|
| A | Excellent Performance | Students with excellent performance in the course demonstrate a comprehensive grasp of lecture materials, effectively utilize tools discussed, achieve exemplary results in lab session exercises, and excel in various project stages. They consistently exceeded the learning outcomes of the course. They exhibit exceptional software skills, meticulous project planning, efficient teamwork, and effective leadership abilities. |
| B | Good Performance | Students with good performance in the course demonstrate a solid understanding of lecture materials, proficient use of tools discussed, competent completion in lab session exercises, and successful execution in various project stages. They consistently met the learning outcomes of the course. They showcase commendable software skills, effective project planning, efficient teamwork, and competent leadership abilities. |
| C | Satisfactory Performance | Students with satisfactory performance in the course demonstrate a basic understanding of lecture materials, adequate use of tools discussed, satisfactory completion in lab session exercises, and adequate execution in various project stages. They generally met the learning outcomes of the course. They showcase reasonable software skills, adequate project planning, functional teamwork, and competent leadership abilities. |

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| D | Marginal Pass | Students with marginal performance in the course demonstrate a limited understanding of lecture materials, basic use of tools discussed, partial completion of lab session exercises, and limited execution in various project stages. They met the minimum learning outcomes of the course. They showcase basic software skills, minimal project planning, basic teamwork, and limited leadership abilities. |
| F | Fail | Students with unsatisfactory performance in the course demonstrate a poor understanding of lecture materials, limited use of tools discussed, inability to complete lab session exercises, and inadequate execution in various project stages. They did not meet the minimum learning outcomes of the course. They showcase inadequate software skills, poor project planning, ineffective teamwork, and a lack of leadership abilities. |

**Course AI Policy**

The use of Generative AI in project is permitted with proper acknowledgement, demonstration of GeoSpatial AI (GeoAI) will contribute to the students' work.

**Communication and Feedback**

Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Feedback on assignments will include comments on strengths and areas for improvement. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

**Late Submission Policy**

All assignments and projects are expected to be submitted by the stated due date and time. To ensure fairness for students who submit assignments on time, a penalty for late submission is listed as follows:

- Late submission within 12 hours, 15% penalty will be applied.
- Late submission between 12 to 24 hours, 30% penalty will be applied.
- Late submission for more than 24 hours will not be accepted.

**Required Texts and Materials**

Fu, Pinde. *Getting to Know Web GIS*. Fifth edition ed., Redlands, California, USA, Esri Press, 15 Nov. 2022.

Kass Green, et al. *Imagery and GIS Best Practices for Extracting Information from Imagery*. Redlands, California, USA, Esri Press, 2017.

Shrewsbury, Bonnie, and Barry Waite. *Top 20 Essential Skills for ArcGIS Pro.* Redlands, California, USA, Esri Press, 5 Sept. 2023.

Tang, Winnie. *Smart City 4.0*. 2021. Hong Kong, Esri China (Hong Kong) Ltd., Mar. 2022, winnietang.hk/ebook/SmartCity4.0_Eng.pdf

**Academic Integrity**

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.