THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Outcomes Based Curriculum Design of BSc(Hons) in Geomatics

3+3+4 Symposium
December 14, 2009

Prof. Esmond Mok
Department of Land Surveying & Geo-Informatics

Current Programme Curriculum

- The University started to implement the outcomes based teaching and learning approach about four years ago. All undergraduate programme curricula were required to convert to outcomes based (OBC).

- Departments were given the OBC development framework and guidelines. Within the framework, departments had the flexibility to design their own OBC according to the characteristics and emphasis of the study programme. The current OBC of BSc(Hons) in Geomatics is just one of many examples.

Future Programme Curriculum

- The goal of the future 4-year undergraduate curriculum is to promote the all-round development of human potentials to the fullest extent for the professions.

- In addition to developing students' professional competencies in a chosen discipline with a broad knowledge base, the following generic competencies are emphasized:

Critical thinking and problem-solving abilities

Leadership and teamwork skills

Communication and language skills

Global outlook

Entrepreneurship

Creativity and innovation

Social and national responsibility

Cultural appreciation

Healthy lifestyle

Lifelong learning capability

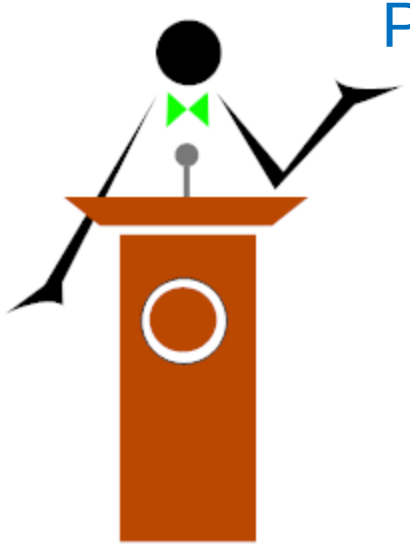
***Subject* requirements for 4-year programmes**
• **General University Requirements (GUR)**
• **Discipline-specific Requirements (DSR)**

GUR is to ensure that students are given sufficient opportunities in the 4-year undergraduate curriculum to:

- acquire the foundation knowledge and skills that underpin their major study
- acquire their language and communication skills to facilitate their university studies
- expand their intellectual capacity beyond their disciplinary domain so as to enable them to tackle professional and global challenges from a multi-disciplinary perspective, and in a holistic manner
- gain an increased understanding of China (e.g. its history, culture and society, as well as its emerging issues/challenges)
- develop a more healthy lifestyle, and
- develop a sense of ethical conduct as a citizen and a professional

***Subject r*equirements for 4-year programmes**
• **General University Requirements (GUR)**
• **Discipline-specific Requirements (DSR)**

would follow the existing OBA curriculum design concept, to help students develop discipline specific technical/ professional knowledge, as well as generic competencies emphasized in the profession.



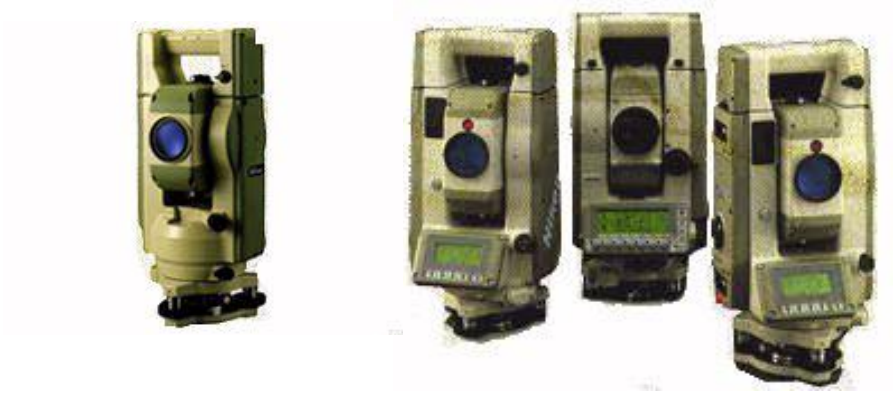
Experience sharing on curriculum design of the current undergraduate Degree Programme: BSc(Hons) in Geomatics

This approch would also be applied in the development of the 4-year DSR programmes and subject syllabi

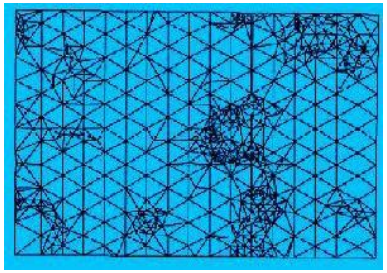
Geomatics:

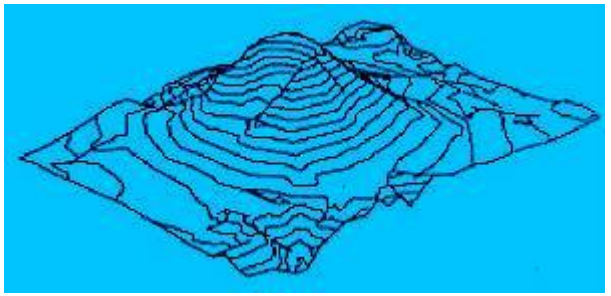
Techniques and technologies on the collection, processing, analysis, interpretation, presentation, management of spatial/geo data, for a wide spectrum of applications.

Traditional Positioning Techniques

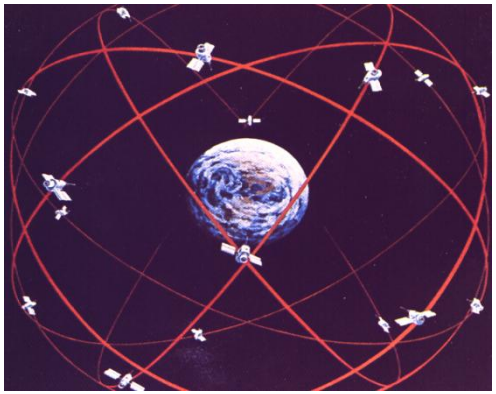


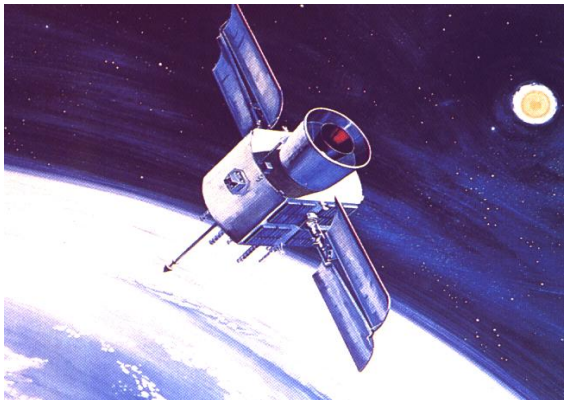
Angle and Distance Measurements

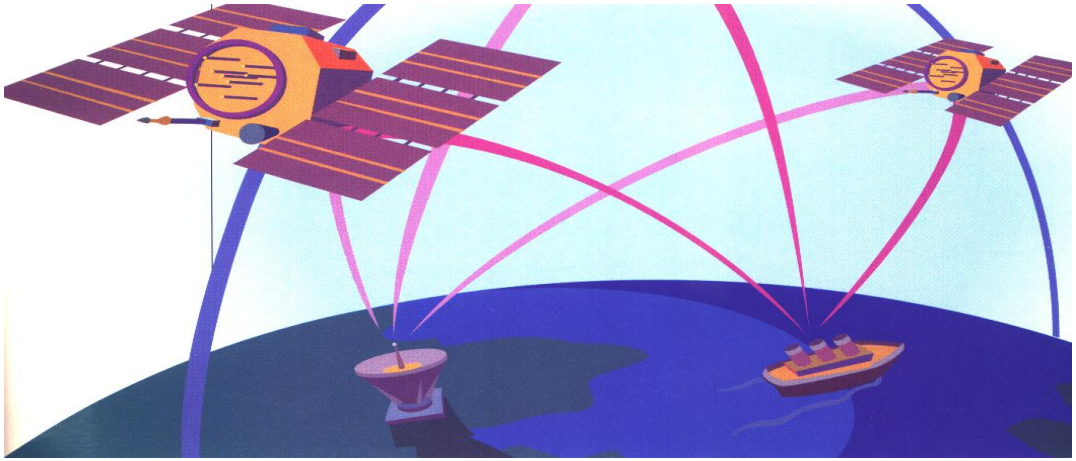




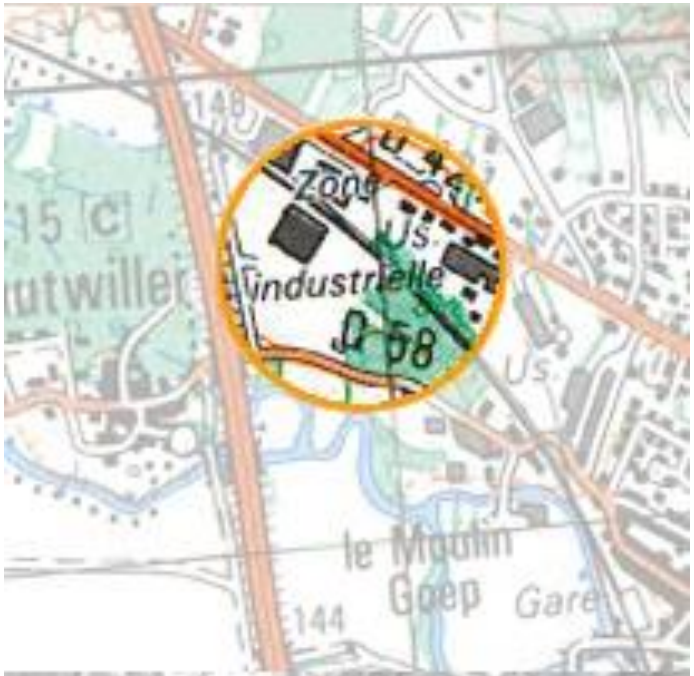
Satellite Positioning



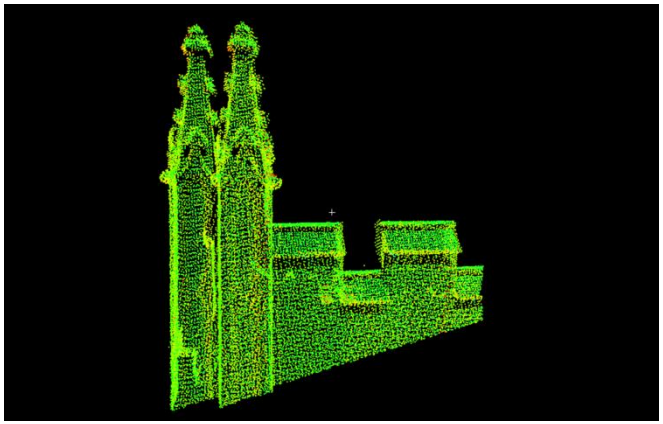


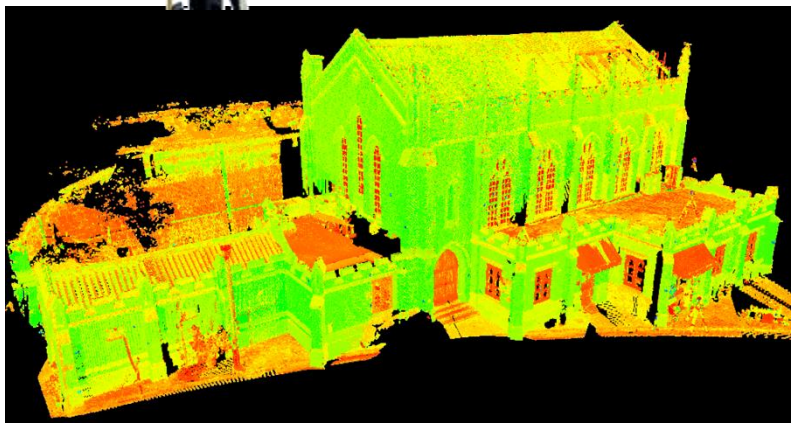


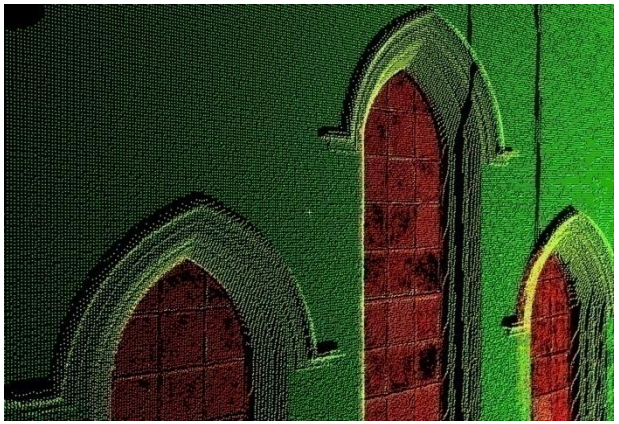
Satellite Image
Aerial Photographs



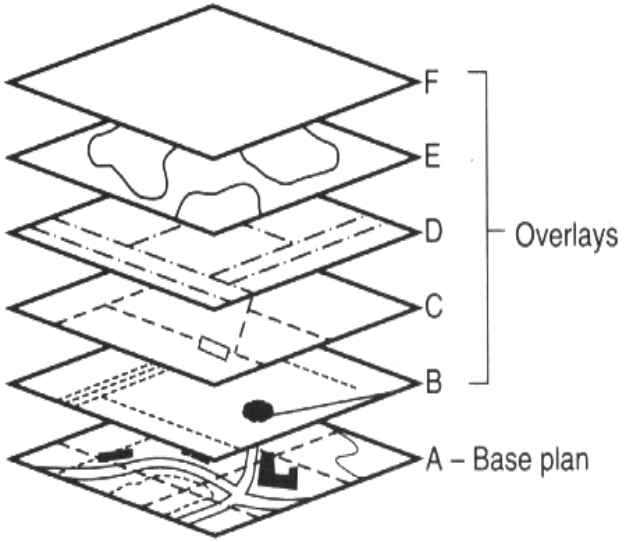
Laser Scanning for Modeling of 3D Objects





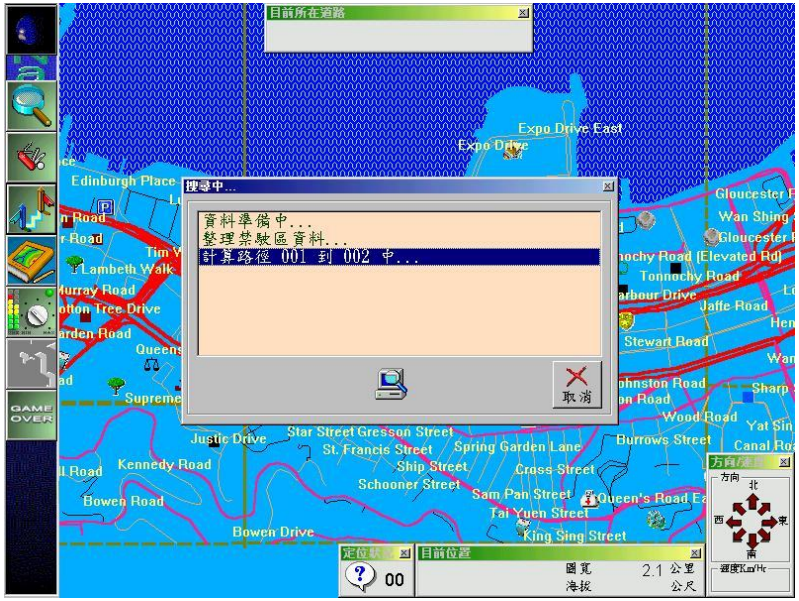


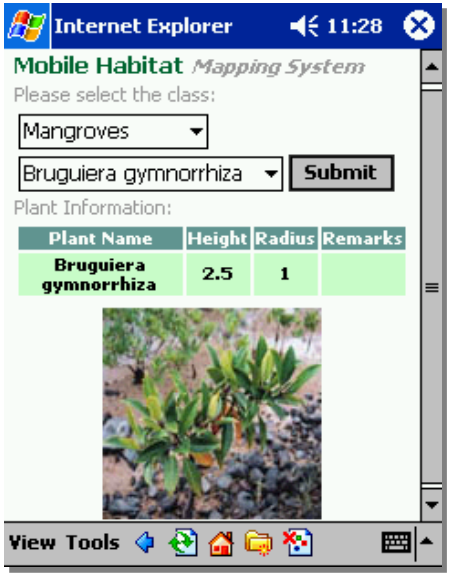
Map Making and Geo-spatial Information Management Using Geographic Information Systems (GIS)



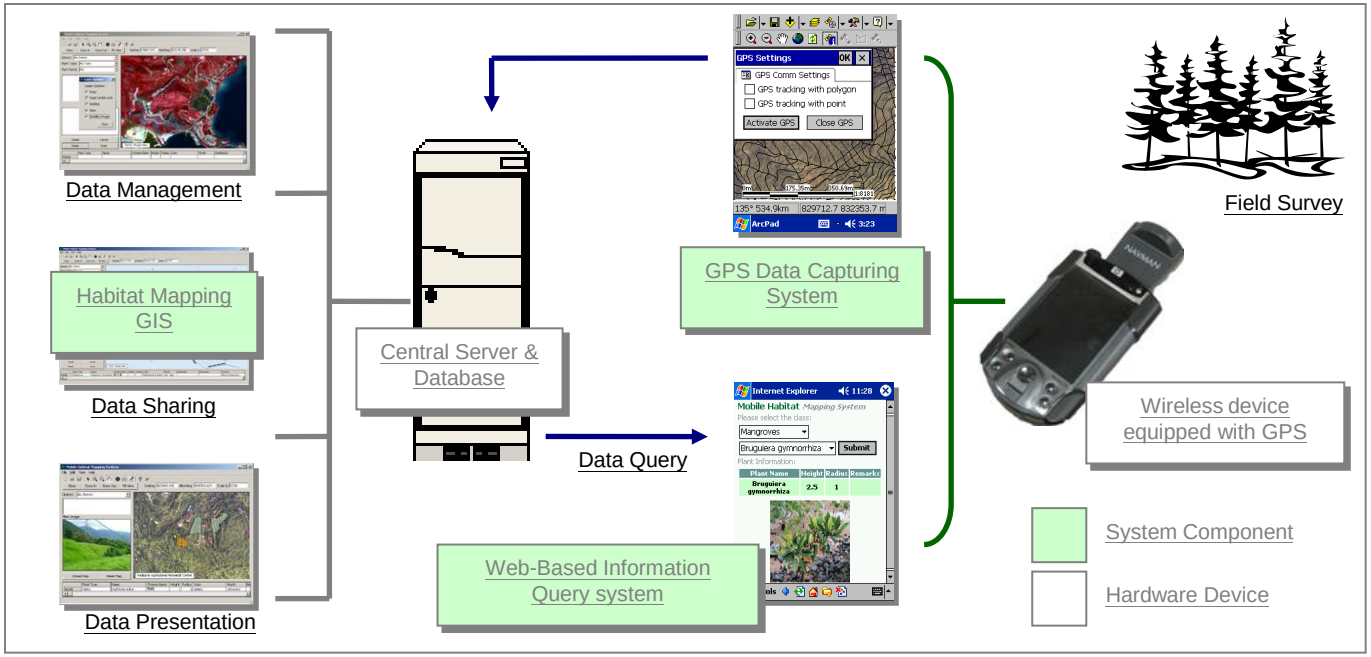
Vehicle Navigation

(satellite positioning, digital map, GIS)



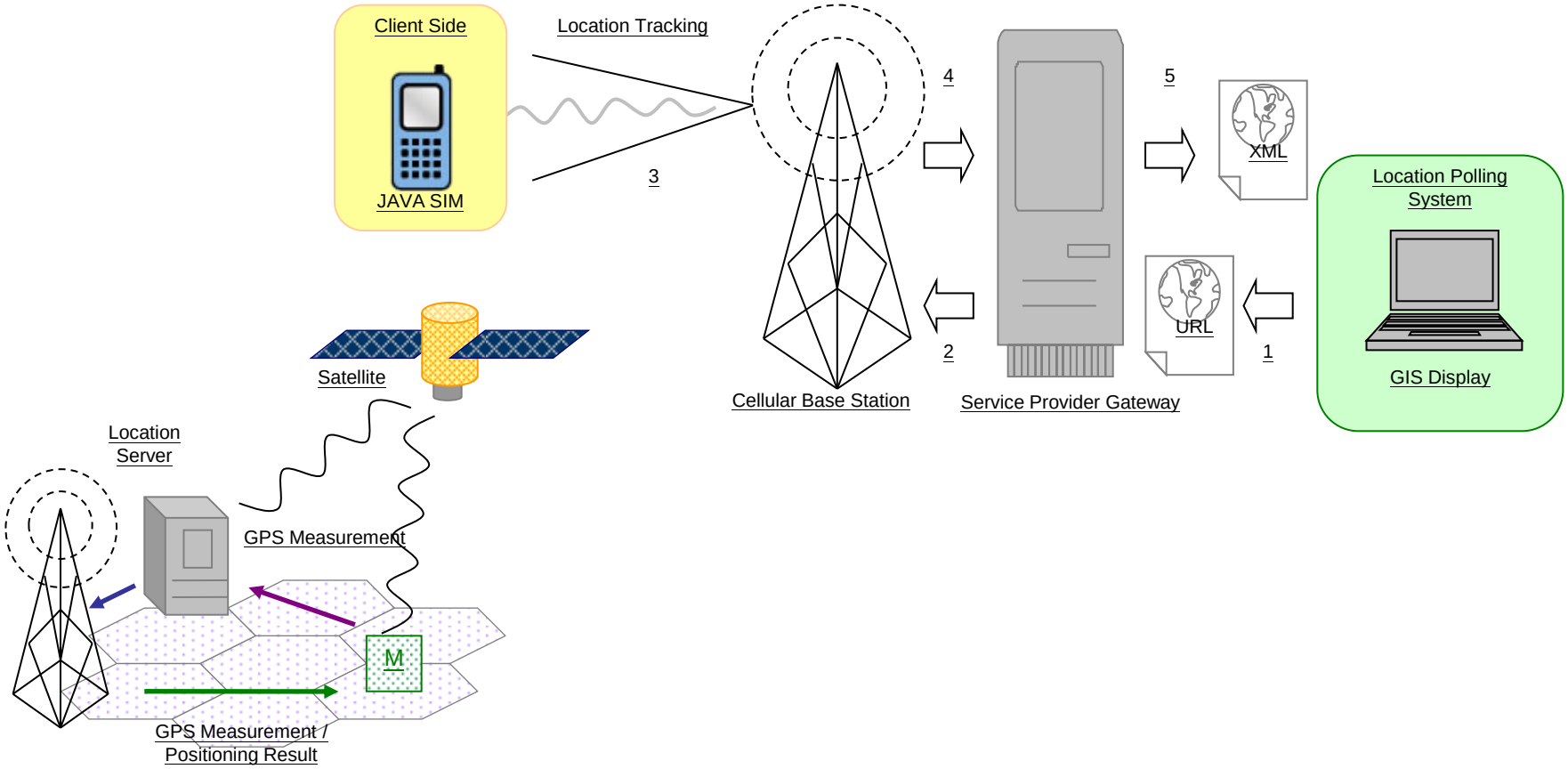


Habitat Mapping
(mapping of vegetation distribution using GPS, GIS, mobile communication)



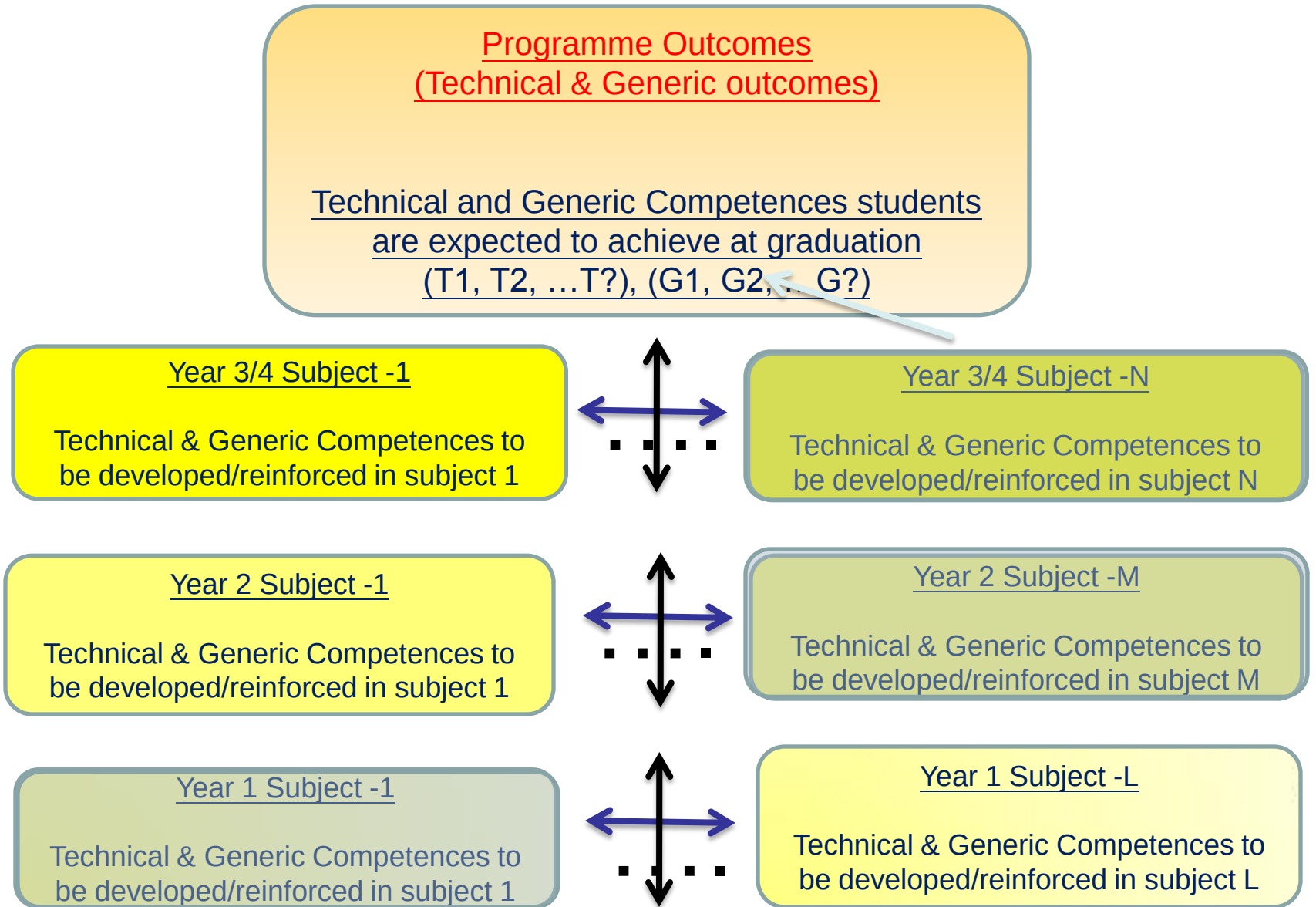
Location Based Services

Provide advice on, e.g. “where are Chinese restaurants around me, and how to get there?”



General Structure of Outcomes Based Curriculum

General Structure of an Outcomes Based Curriculum



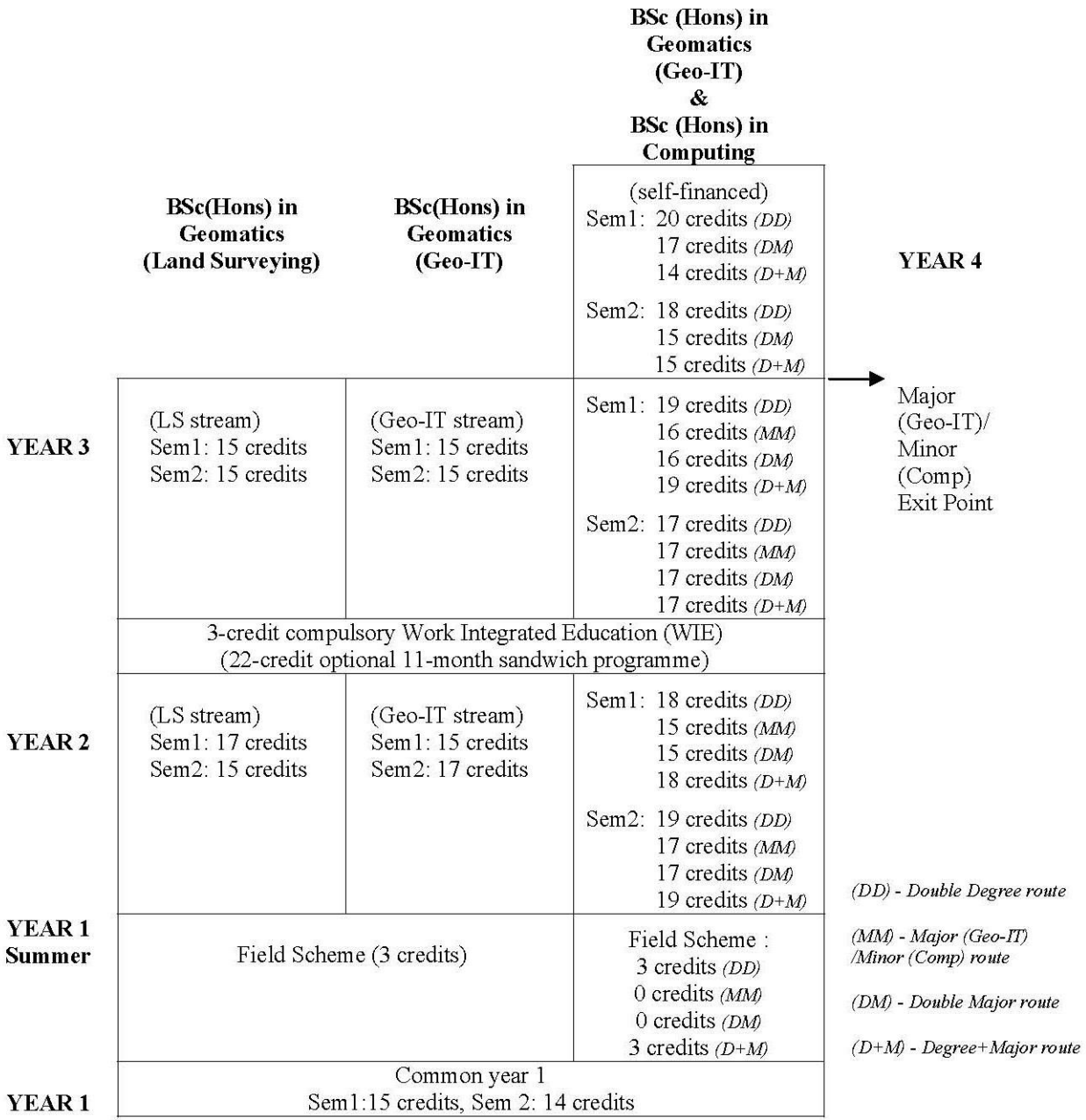


Table 1: Programme Structure

Programme Aims and Programme Outcomes

Programme Aims

Land Surveying Stream

To provide education to meet the modern land surveyor manpower requirement of Hong Kong professional bodies.

Geo-Information Technology (Geo-IT) Stream

To provide education for graduates to work competently as GIS professional with managerial responsibilities of the GIS system design, analysis and management of geographic information in transport & logistics, environmental, commercial, and construction applications.

Students after graduation will have acquired the knowledge and practical Skills necessary for a land surveyor/Geo-IT professional at “Entry Level”

Major(Geo-IT) and Minor(COMP)

To provide education for graduates to be able to carry out and manage technical details of GIS projects, software customization and development.

Double Degree

To provide education for graduates competent in both Geo-IT and Computer Science adaptable to the changing market demands on Geo-IT and general IT in Hong Kong and Chinese mainland.

Programme Outcomes

Technical Outcomes

1. Academic Knowledge, 2. Professional Knowledge

Generic Outcomes

Technical Outcomes: Academic Knowledge

	Understanding Level			
Key Knowledge Areas	**LS Stream**	**Geo-IT Stream**	**Major(Geo-IT) Minor (Comp)**	**Double Degree**
K1. Engineering Mathematics	substantial knowledge	fundamental knowledge	fundamental knowledge	substantial knowledge
K2. Computer Science/Information Technology	fundamental knowledge	fundamental knowledge	substantial knowledge	in-depth knowledge
K3. Geographic Information System	fundamental knowledge	in-depth knowledge	substantial knowledge	in-depth knowledge
K4. Land & Hydrographic Surveying	in-depth knowledge	fundamental knowledge	fundamental knowledge	fundamental knowledge
K5. Error Theory and Data Analysis	in-depth knowledge	fundamental knowledge	fundamental knowledge	fundamental knowledge
K6. Management	substantial knowledge	substantial knowledge	substantial knowledge	substantial knowledge
K7. Data Presentation and Visualization	substantial knowledge	substantial knowledge	substantial knowledge	substantial knowledge

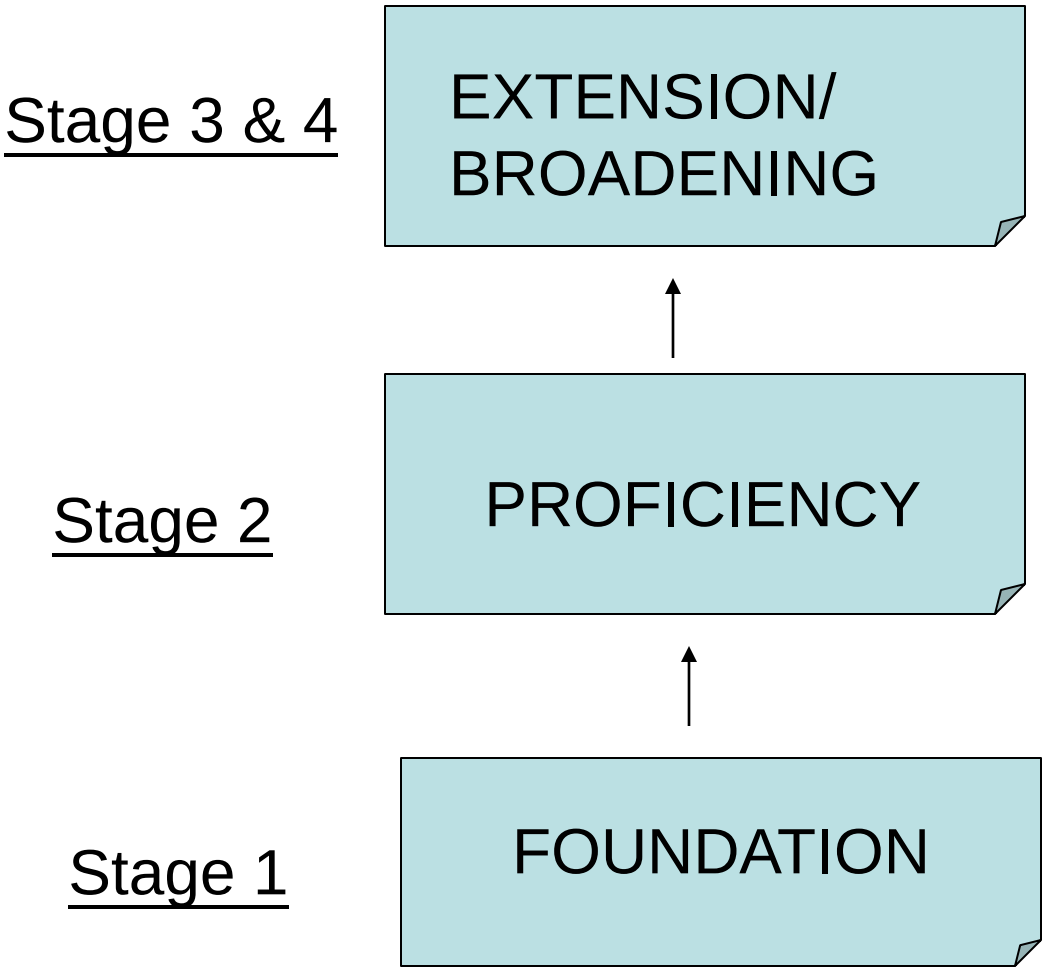
Technical Outcomes: Professional Knowledge

Abilities	LS Stream	Geo-IT Stream	Major (Geo-IT), Minor (Comp)	Double Degree
P1. Able to apply appropriate mathematical and computer knowledge to solve problems and analyze data	√	√	√	√
P2. Able to identify and correctly apply appropriate Geomatics concepts to solve problems and analyze data relating to surveying applications	√			
P3. Able to Identify and correctly apply appropriate mapping and GIS concepts to solve problems and analyze data relating to geo-IT applications		√	√	√
P4. Able to develop appropriate standards and exploit their knowledge of modern surveying equipment for the designing, collecting, processing, interpreting, analyzing, integrating and managing of survey data according to a client's specification	√			
P5. Able to develop appropriate standards for the designing, collecting, processing, interpreting, analyzing, integrating and managing of GIS data and systems according to a client's specification		√		√
P6. Able to develop Geo-IT software and customization according to a client's specification			√	√
P7. Able to work and supervise others in accordance with, and abide by, the legal, ethical and professional standard	√	√	√	√
P8. Able to integrate the various technologies to solve Geomatics problems in a professional, timely and cost effective manner	√			
P9. Able to integrate the various technologies to solve Geo-IT problems in a professional, timely and cost effective manner		√		
P10.Able to integrate the various technologies to solve general IT and Geo-IT problems in a professional, timely and cost effective manner			√	√

Generic Outcomes (5 major areas)

Generic Outcomes
A1. Able to communicate effectively in English and demonstrate suitable presentation skills
A2. Have correct attitudes and behavior of working with others
A3. Able to think critically and creatively
A4. Have developed entrepreneurship concepts and ideas
A5. Global outlook

Alignment of subject and programme outcomes



Foundation

- Develop students fundamental knowledge and concept
- Develop students equipment operation skills
- Develop students sufficient pre-requisite knowledge for the more advanced surveying and Geo-IT concepts and methods to be introduced in the second year.
- Field/laboratory work to help students develop the concept of standards and specification requirements, field operation procedures, and management concepts

Proficiency

- Knowledge development stage

- Students to learn, compare and relate different methods in the collection, processing, interpreting, analyzing and managing geo-data

- Case-based learning and Problem-based learning are emphasized in this year in order to help students achieve the higher order thinking, and to relate knowledge to applications
  Help students develop critical and creative thinking

- Experts and practitioners in the field are invited to share their real-life experience and act as facilitators in the PBL process.

Extension/Broadening

- Students to receive a more in-depth knowledge in their specialised areas

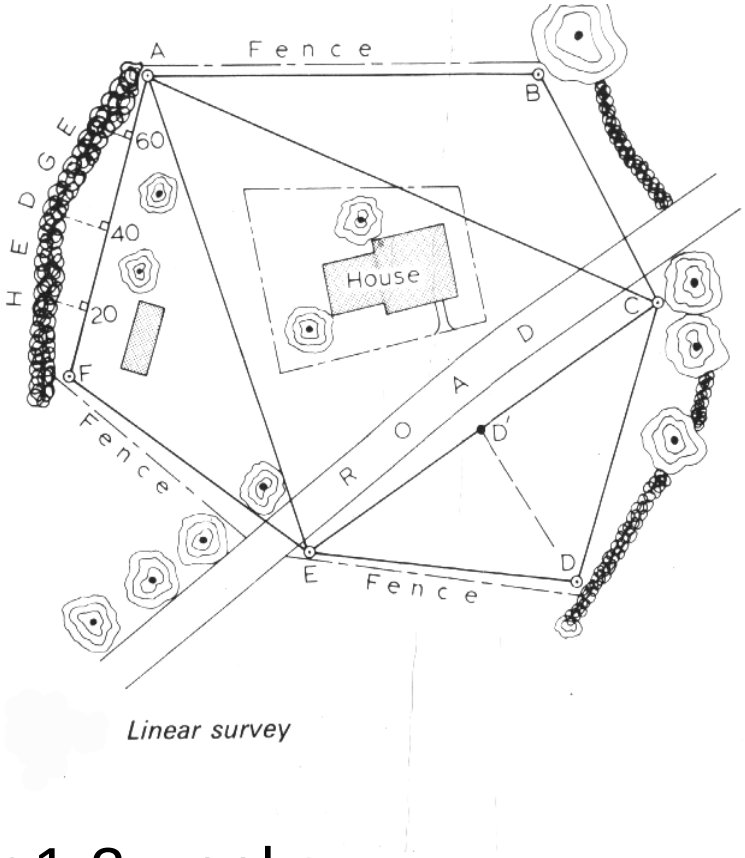
- Critical and creative thinking are reinforced through individual/group projects, team discussions and presentation. Students learn from each other and generate new ideas

- Professionals are invited to propose real-life project titles and/or provide expert advice during the project period

Major Teaching and Learning Methods

- Interactive Lecture
- On-line delivery
- Field/Lab Work
- Field Scheme
- Case-based/problem-based learning
- Tutorial

Field Scheme



Linear survey

- Students stay in a project site for 1-2 weeks
- Students are given project requirements, they have to complete the project within the project period
- Assessment: CA on field performance + oral examination


Leica


WILD SR299
Leica

Subject Outcomes

Subject Syllabus

PART A – Subject specific information

Aims and Outcomes

A. Professional/academic knowledge and skills

At the end of this subject students who gain a pass will be able to:

- Describe the functions and operation of modern survey equipment (L2)
- Explain sources of errors in survey measurements and apply proper field procedures to reduce or eliminate these errors (L3)
- Describe how a survey coordinate system is established and the conversion from one plane coordinate system to another (L2)
- Compare different control and positioning techniques and their booking methods (L3)
- Correctly apply the control and positioning techniques under different site conditions and specification requirements (L3)
- Confidently carry out the field scheme I project according to specification (L4)

Level 1 (L1): Recall definitions, do simple procedures and calculations that largely rely on memorizing.

Level 2 (L2): Describe concepts and procedures, do intermediate level of calculations that require some conceptual understanding, discuss issues by combining different ideas.

Level 3 (L3): Compare, explain, analyze, relate and apply mathematical models, ideas, theories and concepts.

Level 4 (L4): Discuss advanced theories and concepts, derive mathematical models, theorize and hypothesize study topic areas, generate new knowledge, integrate knowledge to carry out design and project work.

B. Attributes for all-roundedness

Students' communication skill, leadership and cooperative attitudes of work with others will be developed through group field practicals.

Keyword Syllabus

A. …
B. …
C. …

Content Distribution

A	B	C	D	E	F
10%	20%	20%	20%	20%	10%

PART B - Teacher specific information

- Teaching and Learning Methodologies
- Assessment Methods
- Reading List

Design of Alignment Between Subject and Programme Outcomes

I: Introduction, R:Reinforcement, A: Assessment

		Subject									
Programme Outcomes List programme outcomes in this column in the same order as in the outcomes section for easy referencing		P1. Able to apply appropriate mathematical and computer knowledge to solve problems and analyze data	P2. Able to identify and correctly apply appropriate Geomatics concepts to solve problems and analyze data relating to surveying applications	P3. Able to Identify and correctly apply appropriate mapping and GIS concepts to solve problems and analyze data relating to geo-IT applications	P4. Able to develop appropriate standards and exploit their knowledge of modern surveying equipment for the designing, collecting, processing, interpreting, analyzing, integrating and managing of survey data according to a client's specification	P5. Able to develop appropriate standards for the designing, collecting, processing, interpreting, analyzing, integrating and managing of GIS data and systems according to a client's specification	P6. Able to develop Geo-IT software and customization according to a client's specification	P7. Able to work and supervise others in accordance with, and abide by, the legal, ethical and professional standard	P8. Able to integrate the various technologies to solve Geomatics problems in a professional, timely and cost effective manner	P9. Able to integrate the various technologies to solve Geo-IT problems in a professional, timely and cost effective manner	P10. Able to integrate the various technologies to solve general IT and Geo-IT problems in a professional, timely and cost effective manner
Stage 1	Surveying	I	I&A	I	I&A	I		I			
	Mapping	I	I	I		I					
	Principles of Programming	I					I				
	Mathematics	I&A									
	English in the Workplace for the Faculty of Construction and Land Use (FCLU)										
	General Education I										
	CAD and Processing for Geomatics	I&A	I	I			I		I	I	I
	Survey Adjustment	I	I&A	I	I&A	I			I	I	I
	Field Scheme I	I&A	I&A	I	I&A	I		I	I&A	I	I
	Data Structures & Algorithms	I		I		I	I			I	I
	Fundamentals of GIS	I&A	I	I		I	I			I	I

		Subject									
	Programme Outcomes List programme outcomes in this column in the same order as in the outcomes section for easy referencing	P1. Able to apply appropriate mathematical and computer knowledge to solve problems and analyze data	P2. Able to identify and correctly apply appropriate Geomatics concepts to solve problems and analyze data relatng to surveying applications	P3. Able to Identify and correctly apply appropriate mapping and GIS concepts to solve problems and analyze data relatng to geo-IT pplications	P4. Able to develop appropriate standards and exploit their knowledge of modern surveying equipment for the designing, collecting, processing, interpreting, analyzing, integrating and managing of survey data according to a client's specification	P5. Able to develop appropriate standards for the designing, collecting, processing, interpreting, analyzing, integrating and managing of GIS data and systems according to a client's specification	P6. Able to develop Geo-IT software and customization according to a client's specification	P7. Able to work and supervise others in accordance with, and abide by, the legal, ethical and professional standard	P8. Able to integrate the various technologies to solve Geomatics problems in a professional, timely and cost effective manner	P9. Able to integrate the various technologies to solve Geo-IT problems in a professional, timely and cost effective manner	P10. Able to integrate the various technologies to solve general IT and Geo-IT problems in a professional, timely and cost effective manner
Stage 2	Cartography	R&A	R	I&A	R	I, R&A			R	R	R
	Digital Terrain Modelling and Visualisation	R&A	R&A	R		I&R			R	R	R
	Geomatics Programming	I,	R&A	R&A			I&A			R	
	Remote Sensing	I,	R&A	R&A	R				R&A	R&A	R&A
	Survey Instrumentation	R	R		R				R&A		
	Photogrammetry I	R	R	R	R				R&A	R&A	
	Construction Surveying	R&A	R&A		R			R	R&A		
	Geodetic Control	R	R&A		R				R&A		
	Construction Technology and Management							R	R		
	Advanced Survey Adjustment	R&A	R&A		R				R&A		
	Cadastre and Land Management		R		R			R	R&A		
	Communication and Positioning	R		R						R&A	
	Geospatial Database and Data Infrastructure	I,		R&A		R&A	R&A		R	R&A	R&A
	Spatial Analysis	I,		R&A		R&A			R	R&A	R&A
	Data Integration and System Customisation	R&A		R&A		R&A	I&A			I,	
	GIS Project			R&A		R&A		R		R	
	General Education II										
	Discrete Structures	R		R							R&A
	Foundations of Database Systems	R		R			R				R&A
	Integrated GIS Project	R&A		R&A		R&A	R&A				R&A
	Operating Systems	R		R			R				R&A

Teaching Plan and Assessment Criteria for Students

LSGI3343

Subject Code: LSGI3343
Subject Title: Communication and Positioning
Subject Level: 3
Subject Weight: 0.3
Credit Value: 3
Contact Hour: Lect/Tut: 21 PW: 42

Pre-requisite Knowledge

Nil

Subject Lecturer

Lecturer: Prof. Esmond Mok
Location: HJ705
Phone: 27665953
Email: lsemok@inet.polyu.edu.hk

Help Needed?

Send an email for an appointment for arranging a discussion session.

Assessments

100% continuous assessment

Quiz at start of each lecture : 15%
One SOLO test : 20%

Quiz and test questions will be graded based on the following performance:

Academic/professional knowledge	weight	: 0.7
Communication	weight	: 0.3

Oral Examination on knowledge learned in practical sessions : 30%

Oral Examination will be graded based on understanding of pracrtical procedures and technical knowledge.

Mini Project : 35%

Mini Project will be graded based on the following performance:

Critical thinking and problem solving skills	weight	: 0.65
Creativity	weight	: 0.15
Communication	weight	: 0.2

1 Introduction

Location Based Services (LBS) is increasingly popular worldwide as its applications cover a wide spectrum of wireless users such as vehicle navigation, manpower and fleet management, transport logistics, travel aids and location identification in case of emergency. A key technology support for LBS is position determination. The advancement of electronic and wireless computing technologies has driven the development of modern positioning and communication technologies. In this subject you will learn the principles and practices of different modern positioning and communication technologies, and their integration with GIS to support various LBS applications.

2 Subject Curriculum

Aims

The aim of this subject is to provide you opportunities to explore different up-to-date positioning and communication technologies, and their integrations with GIS for different location based applications.

Objectives

- To provide an understanding of the fundamental principles of data communications and modern positioning methods
- To familarise you with typical positioning and communications systems commonly adopted for location based applications
- To develop your communication ability, problem solving skills, creative and critical thinking by reinforcing these domains in the teaching and learning process and assessments.

Outcomes of professional/academic knowledge and skills

Date	Study Area	Keyword Syllabus
07-SEP-09	Overview of positioning Techniques. Satellite based positioning & Network Assisted GPS Positioning (I)	A1, A 2, A3
14-SEP-09	Satellite based positioning & Network Assisted GPS Positioning (II) (Pract: GPS Positioning, data processing)	A1, A2, A3
21-SEP-09	Parallel and serial communications. RS-232 standard. Data transfer programming techniques (Pract: GPS Positioning - NTRIP)	B2, B3, C2
28-SEP-09	Radio signal and signal transmission. Signal strength. Transmission impairment. (Pract: programming on data transfer and data extraction)	B1, B5
05-OCT-09	Wireless LAN. IEEE 802.11 Standard. WiFi Positioning (Pract: WiFi positioning)	A4, B4
12-OCT-09	Ad Hoc Network and ZigBee Positioning (Pract: ZigBee positioning)	A4, B4
19-OCT-09	SOLO TEST	
26-OCT-09	HOLIDAY	
02-NOV-09	ORAL EXAMINATION, Preparation of Mini Project	A2, C1, C2
09-NOV-09	Mini Project	A2, C1, C2
16-NOV-09	Mini Project (Submission of personal comments of P1)	A2, C1, C2
23-NOV-09	Mini Project	A4, C1, C2
30-NOV-09	Mini Project (Submission of personal comments of P2)	A4, C1, C2

University's Grading System

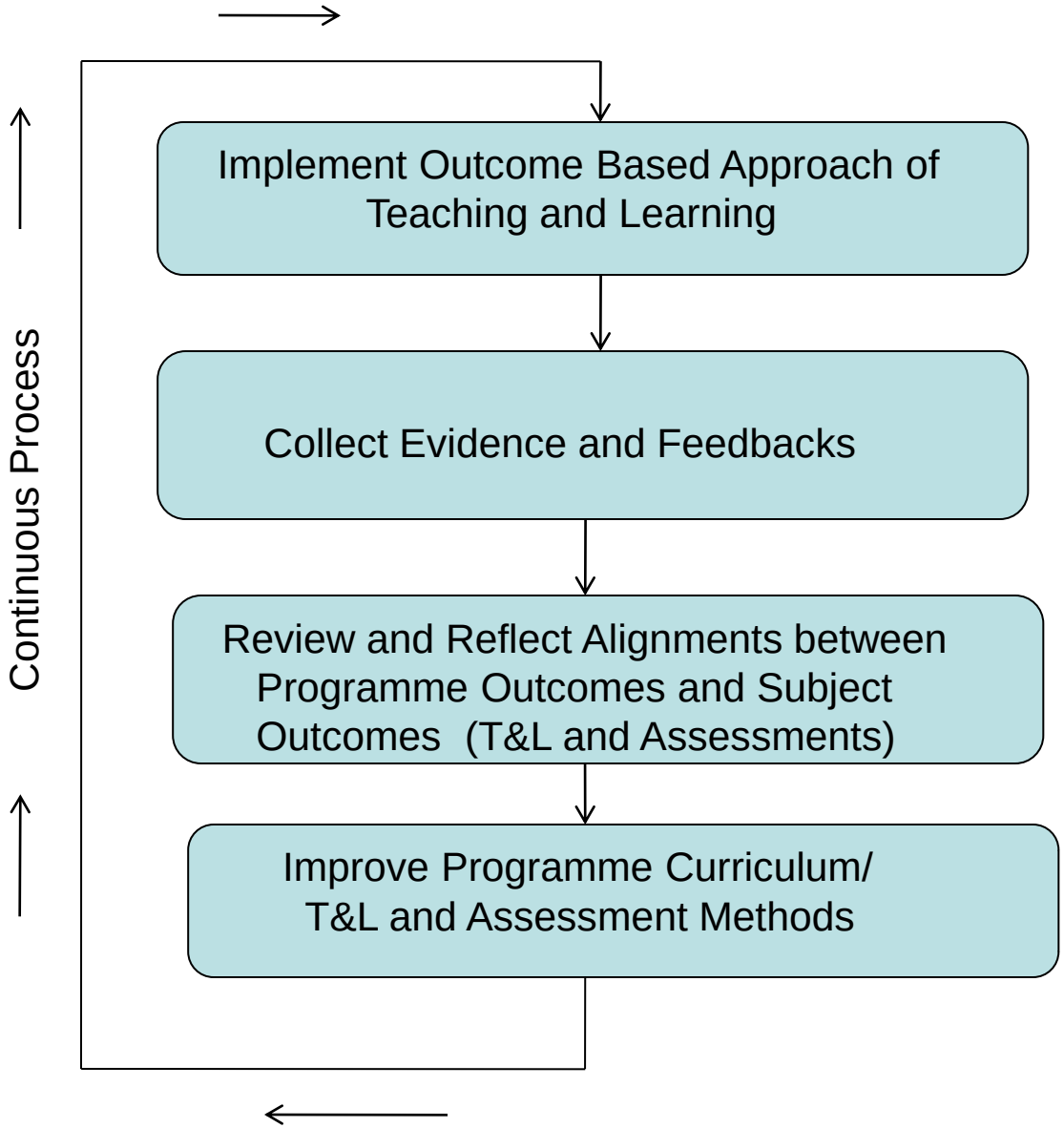
Assessment grades shall be awarded on a criterion-referenced basis. A student's overall performance in a subject shall be graded as follows:

Subject grade	*Short description*	*Elaboration on subject grading description*
A+	Excellent	The student's work is outstanding. It exceeds the subject learning outcomes in all regards.
A		The student's work is excellent. It exceeds the subject learning outcomes in nearly all regards.
B+	Good	The student's work is very good. It exceeds the subject learning outcomes in the majority of regards.
B		The student's work is good. It exceeds the subject learning outcomes in some regards.
C+	Satisfactory	The student's work is wholly satisfactory. It fully meets all the subject learning outcomes.
C		The student's work is satisfactory. It largely meets all the subject learning outcomes.
D+	Marginal	The student's work is barely adequate. It fails marginally to meet all the subject learning outcomes.
D		The student's work is weak. It fails to meet the subject learning outcomes in some regards.
F	Failure	The student's work is inadequate. It fails to meet most of the subject learning outcomes.

'F' is a subject failure grade, whilst all others ('D' to 'A+') are subject passing grades. No credit will be earned if a subject is failed.

Quality Assurance

Outcomes Based Education



THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Review and Enhancement of Outcomes-Based Education Implementation in LSGI

Editor-in-Chief: Professor Esmond C.M. Mok
Editor: Dr.Margaret Taplin

THANK YOU