Course Specification

(Postgraduate Programs)

Course Title:	Advanced Surveying
Course Code:	CEG5003
Program:	Higher Diploma in Geographic Information System
Department:	Civil Engineering Department & Geography Department
College:	College of Social Sciences
Institution:	Umm Al-Qura University
Version:	V1
Last Revision Date:	7 December 2024

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: (3 Credit hours)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 1 / First year)					
4. Course general Description:					

The course covers the main aspects and application fields of different types of land, GPS and photogrammetry surveys. The course encompasses map production, extraction of Digital Terrain Models (DTM), building extraction, engineering applications using different surveying devices and techniques. It explains the surveying devices such as level, theodolite, EDM, total station, terrestrial laser scanner, GPS receivers and digital photogrammetry workstation.
It includes the explanation of map projection and transformation between coordinate systems. It presents all aspects of GNSS needed to use GPS including the basics of GPS technology, common hardware, surveying methods, survey design, planning and observations.
The courses emphasis on the description of the elements of analytical photogrammetry such as photo coordinates measurements and refinement , analytical camera calibration, aerotriangulation process, sequential block adjustment, bundle block adjustment. This course also provides deep explanation of digital photogrammetry, analytical plotters and Digital Photogrammetric Workstations (DPWs).
The course contains the different methods and softwares for data processing and presentation, and map production.
The integration of GPS, photogrammetry and laser scanning with GIS are included.

5. Pre-requirements for this course (if any)**:**

N/A

6. Pre-requirements for this course (if any)**:**

N/A

7. Course Main Objective(s):

The main objectives of this course that the student:

- Will be able to use modern site surveying devices such as total station, laser scanner and GPS receivers to develop his skill in surveying techniques.
- Will apply the principles and analytical techniques for some different surveying applications.
- Understand principle of land, GPS and photogrammetry surveys.
- Create digital terrain model from different types of surveying techniques.
- Integrate GPS, photogrammetry and laser scanning with GIS to widen the application fields of surveying.

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	75	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	30
2.	**Laboratory/Studio**	45
3.	**Field**	
4.	**Tutorial**	
5.	**Others (specify)……**	
	Total	75

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	To explain the need of surveying and its applications.	**K1**	• Lectures • Lab. work	• Written Exams • laboratory and fieldwork reports • Lab Exams
1.2	To outline the principles of geospatial tools and techinques such as land surveying, GPS and photogrammetry and their	**K2**	• Lectures • Lab. work	• Written Exams • laboratory and fieldwork reports • Lab Exams

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	applications.			
1.3	To discuss the need of surveying methodologies for GIS applications.	**K3**	• Lectures • Lab. work	• Written Exams • laboratory and fieldwork reports • Lab Exams
2.0	**Skills**			
2.1	Analyzing the spatial data obtained from different modern surveying techniques, instruments and softwares.	**S1**	• Lectures • Lab. Work	• Written Exams • Lab Exams
2.2	To analyze and interpret data required for using land, GPS and photogrammetry surveys for solving GIS positioning problems and applications.	**S2**	• Lectures • Computer Work	• Written Exams • Oral exams.
3.0	**Values, autonomy, and responsibility**			
3.1	To integrate professionally and ethically in a team work for surveying applications.	**V1**	• Group assignments. • Small group work. • Lab. work.	• Lab. Exam • Oral exams.
3.2	To use life-long learning and continuing education for surveying techniques, instrumentation and softwares.	**V2**	• Group assignments. • Small group work. • Lab. work.	• Lab. Exam • Oral exams.

C. Course Content:

No	List of Topics	Contact Hours
1	Introduction in land surveying techniques, Electronic Surveying Measurements using Total Station, Field Procedures for Total Stations in Topographic Surveys.	5
2	Principles of laser scanners, Components of laser scanners, Basics of airborne laser scanning, Operational aspects of airborne laser scanning, Airborne lidar bathymetry	5
3	Introductory to GPS, Earth shape, The Ellipsoid and Geodetic Coordinates, Ellipsoidal Coordinates, and map projection	5
4	Transformation between Geodetic and Cartesian Coordinates systems	5
5	GNSS Datums and references	5
6	Different GNSS observation techniques	5
7	Data processing procedures	5
8	Integration of GNSS with other techniques (GIS, RS, Echo-Sound)	5
9	GNSS reference station networks in Kingdom of Saudi Arabia.	5
10	Introduction to Photogrammetry, Applications of Photogrammetry, Introduction, Classification of aerial photographs, Ground Control of Photography, Geometric properties of aerial photographs	5
11	Vertical and Overlap Photographs, Stereoscopy, Mosaics, Stereoscopic and Plotting Instruments.	5
12	Elements of Analytical Photogrammetry, Concept of Image and Object Space, Coordinate Systems, Photo coordinates measurements and refinement.	5
13	Digital Photogrammetry, Digital Photogrammetric Workstations (DPWs), Basic System Components, Basic System Functionality,	5
14	Map production using softwares.	10
Total		75

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1	First exam	2	5%
2	Second exam	7	10 %
3	Third exam	10	10 %
4	Report and Oral Exam	12	10 %
5	Practical Examination.	15	15 %
6	Final Exam	16 /17	50 %
Total			100 %

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	• Ghilani, C. D. "Elementary Surveying", 16th Edition, Pearson, 2021 • Wolf, P.R. and B.A. Dewitt, 2016. Elements of photogrammetry with applications in GIS. 5th edition, McGraw-Hill.
Supportive References	• Vosselman, G. and Maas, M. , 2018. Airborne and Terrestrial Laser Scanning, 3rd Edition, Whittles Publishing, Dunbeath, Caithness KW6 6EY, Scotland, UK. • Shusen Tan, 2018. GNSS systems and engineering, John Wiely & Sons, Singapore • Hegarty, C. J., and Kaplan, E. D., 2017. Understanding GPS/GNSS: Principles and Applications. Artech House, USA. • Linder, W., 2016. Digital photogrammetry. A practical course. Springer-Verlag, Berlin. TA593 .L45 2006 and online via Library link.
Electronic Materials	• http://www.sciencedirect.com. • http://ocw.mit.edu/
Other Learning Materials	Latest Software

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classrooms for lectures and exams for 35 students during the scheduled class hours. • Surveying lab. with sufficient surveying instruments for 20 students during the scheduled lab. or field work hours.
Technology equipment (Projector, smart board, software)	• Data show for some work presentation.
Other equipment (Depending on the nature of the specialty)	Printers and laptops for staff members with required computer software programs are required.

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Faculty members who teach this course and the lab staff associated with the course.	• Both written and verbal, through presentations. • Analysis of students` marks • Regular feedback of the students about the course and the teaching methods
Effectiveness of students assessment	Faculty members who teach this course and those teaching other courses relevant to this course.	• Regular revising and improving of the course contents and consulting the faculty member • Teaching faculty and lab staff associated with the course are also available for personal consultation.
Quality of learning resources	Faculty members who teach this course	• Frequent improvement for teaching and learning techniques. • Frequent survey for latest references. • Encouraging the students in team work cooperation and writing reports.
The extent to which CLOs have	Independent member(s) teaching staff	A sample of students answer sheets is revised by

Assessment Areas/Issues	Assessor	Assessment Methods
been achieved		a specified committee of the department.

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	