Besides undergraduate degrees, the Civil and Environmental Engineering (CEE) Department, University of Houston (UH) had offered four graduate programs: (1) M.S. in Civil Engineering, (2) M.S. in Environmental Engineering, (3) Ph.D. in Civil Engineering, and (4) Ph.D in Environmental Engineering. A new graduate research program in Geosensing Systems Engineering and Science (GSE) was created in early 2010 and is now offering two new graduate programs.

1. M.S. in Geosensing Systems Engineering and Sciences, and
2. Ph.D in Geosensing Systems Engineering and Sciences

GSE graduate studies provide opportunities to students in a broad mix of knowledge that cross traditional areas of engineering and scientific specialties to produce next generation global engineers and scientists. Currently, the program is supported by 7 new faculty members in three departments – 4 in Civil & Environmental Engineering (CEE), 2 in Electrical & Computer Engineering (ECE) and 1 in Earth and Atmospheric Sciences (EAS).

Students with a B.S. degree in engineering, geomatics, geosciences, physics, astronomy, computer sciences, geography, or any related field can be admitted to the GSE graduate research program. A student must provide appropriate and required GRE and TOEFL (for international students only) scores for admission to the GSE graduate program.

M.S. Degree without Thesis: A minimum of 30 credits beyond a B.S. degree (from the approved list)

M.S. Degree with Thesis: A minimum of 30 credits beyond a B.S. (24 from the approved list and 6 research thesis credits). Students must write a thesis, containing original research, and defend it before graduating.

Ph.D. Program: A minimum of 60 credits beyond an approved 30 credits M.S. degree.

Financial Support
Financial assistance is available for qualified students.
GSE GRADUATE COURSES

CEE Core Courses

#1 (CIVE 4398/7397): Introduction to Geomatics and Geosensing (3 cr)
#2 (CIVE 7397): Survey Measurements and Analysis (3 cr)
#3 (CIVE 7397): GNSS/INS and Augmented Systems for Positioning and Navigation (3 cr)
#4 (CIVE 7397): LiDAR Systems and Applications (3 cr)
#5 (CIVE 7397): Satellite Altimetry and Interferometric Synthetic Aperture Radar (3 cr)
#6 (CIVE 7342): Engineering Geographic Information Systems (3 cr)

Dual listing in CEE and EAS Departments

#7 (GEOL 6xxx): Satellite Positioning and Geodesy (3 cr)
#8 (GEOL 6xxx): Natural Hazards (3 cr)

Dual listing in CEE and ECE Departments

#9 (ECE xxxx): ECE course for GSE graduate research program (3 cr)
#10 (ECE xxxx): ECE course for GSE graduate research program (3 cr)
#11 (ECE xxxx): ECE course for GSE graduate research program (3 cr)
#12 (ECE xxxx): ECE course for GSE graduate research program (3 cr)

xxxx: To be developed by Fall 2012

Short Course Descriptions

#1 CIVE 4398/7397 Introduction to Geomatics and Geosensing
   Differential leveling; Distance Measurement; Angular measurement; Computation of traverse and area; Introduction to horizontal and vertical curves computation; Fundamentals of geodesy, geodetic reference systems and map projection; Introduction to Global Positioning System (GPS); Principle of LiDAR technology; Digital imaging and mapping.

#2 CIVE 7397 Survey Measurements and Analysis
   Introduction to matrices; Non-linear equations and Taylor’s Theorem; Random vs Systematic Errors; Propagation of errors; Weights; Principle of least squares, Adjustment of a 1D, 2D and 3D network; Error ellipses; Optimization.


#4 CIVE 7397 LiDAR Systems and Applications
   Principles of LiDAR. Spaceborne LiDAR, airborne topographic and bathymetric, mobile terrestrial and static LiDAR systems and applications. Full Waveform LiDAR. Boresight calibration. Point Cloud Filtering, Segmentation and Classification. Multi-Sensor Fusion.
#5 CIVE 7397 Satellite Altimetry and Interferometric Synthetic Aperature Radar  
Radar measurement principles. Range estimation and corrections. Precise orbit  
determination. Applications in geodynamics, ocean and ice surface monitoring, and  
hydrology. Formation of SAR images. Procedures of InSAR.

#6 CIVE 7342 Engineering Geographic Information Systems  
Use of GIS in Engineering applications including hydrology, hydrogeology, water quality and  
environmental resources.

#7 GEOL 6xxx Satellite Positioning and Geodesy  
Introduction to major space geodetic techniques, the theory of the Global Positioning System  
(GPS), and the applications of high-precision GPS in geosciences and civil engineering. This  
course emphasizes training in GPS data post-processing and real-time processing.

#8 GEOL 6xxx Natural Hazards  
Introduction to the geological processes, geological cycles, analysis, and mitigation of the  
most frequently occurring natural disasters, such as earthquakes, volcanic eruptions,  
tsunami, landslides, subsidence, flooding, and hurricane. This course emphasizes the  
applications of remote sensing technologies (e.g., GPS, LIDAR, INSAR) in natural hazards study  
and mitigation.

### PLANNED COURSE OFFERINGS BY SEMESTER

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The National Center for Airborne Laser Mapping (NCALM, www.ncalm.org), funded by the National Science Foundation (NSF, http://www.nsf.gov/div/index.jsp?div=EAR) and the GSE Graduate Research Program own and operate a combination of equipment and expertise that is unrivaled anywhere in the world. The centerpiece of the program is a twin-engine Cessna 337 airplane, instrumented with a suite of state-of-the-art sensors collectively known as GeMS: Geodetic Mapping Systems.

### GeMS: Geodetic Mapping Systems
University of Houston

#### Airborne
- Cessna 337 Twin Engine Aircraft
- 167 kHz GEMINI LiDAR: 4 stops and intensity, vertical accuracy 4 - 7 cm, point density 6 - 20 per sq. meter
- 70 kHz Aquarius green Laser sensor head for bathymetry: vertical accuracy 5 - 10 cm, point density 5 - 10 per sq. meter
- 60 mega-pixel Forward Motion Compensation (FMC) DiMAC Aerial Camera: Pixel resolution 6 - 8 cm
- 288 bands CASI 1500 Hyperspectral Imager: pixel resolution 30 cm to 1 m

#### Terrestrial
- Optech IRLIS 3D
- Leica HDS 3000
- Z+F 5300
- RiegVZ-400

(1) Cessna 337 Twin Engine Aircraft, (2) 167 kHz GEMINI LiDAR: 4 stops and intensity, vertical accuracy 4 - 7 cm, point density 6 - 20 per sq. meter, (3) 70 kHz Aquarius green Laser sensor head for bathymetry: vertical accuracy 5 - 10 cm, point density 5 - 10 per sq. meter, (4) 60 mega-pixel Forward Motion Compensation (FMC) DiMAC Aerial Camera: Pixel resolution 6 - 8 cm, (5) 288 bands CASI 1500 Hyperspectral Imager: pixel resolution 30 cm to 1 m, (6) Coastal Area Tactical-mapping System for bathymetry and topography (800 kHz equivalent), and (7) Terrestrial Laser Scanners (TLS).

Links:
- GENINI LiDAR: http://www.optech.ca/gemini.htm
- CASI 1500: http://www.itres.com/products/imagers/casi1500
  http://www.optech.ca/i3dhome.htm