COURSE OVERVIEW DE0533
Fundamentals of Geodesy

Course Title
Fundamentals of Geodesy

Course Date/Venue
Session 1: February 17-21, 2025/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: July 27-31, 2025/Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
DE0533

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies and exercises where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of the Fundamentals of Geodesy. It covers the applications of geodesy in science and engineering and its importance in navigation and mapping; the shape of the Earth including Earth's gravitational field, geodetic reference systems and the role of Earth's rotation in geodesy; the coordinate systems, geodetic reference frames, basic geodetic measurements contributions of geodesy to GIS; and the importance of geoid, role of gravity in geodesy, Earth's gravitational field, height systems and vertical datums.

During this interactive course, participants will learn the tides and their effect on geodesy; the physical geodesy applications and classical surveying methods; the global navigation satellite systems (GNSS), satellite geodesy and geodetic instrumentation; the geodetic data processing and network design and adjustment; the dynamic earth and geodetic observations, geodetic datums and transformations including time and geodesy; the geodetic applications in remote sensing; and the geodesy in navigation and transportation, geodetic monitoring of natural hazards and urban and infrastructure development.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain a fundamental knowledge on geodesy
- Discuss the applications of geodesy in science and engineering and its importance in navigation and mapping
- Describe the shape of the Earth including Earth's gravitational field, geodetic reference systems and the role of Earth's rotation in geodesy
- Recognize coordinate systems, geodetic reference frames, basic geodetic measurements contributions of geodesy to GIS
- Explain the importance of geoid, the role of gravity in geodesy, Earth's gravitational field, height systems and vertical datums
- Describe tides and their effect on geodesy and carryout physical geodesy applications and classical surveying methods
- Discuss global navigation satellite systems (GNSS), satellite geodesy and geodetic instrumentation
- Illustrate geodetic data processing and network design and adjustment
- Discuss dynamic earth and geodetic observations, geodetic datums and transformations including time and geodesy
- Carryout geodetic applications in remote sensing and avoid errors and uncertainties in geodesy
- Apply geodesy in navigation and transportation, geodetic monitoring of natural hazards and urban and infrastructure development
- Discuss space geodesy and the future trends in geodesy

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of fundamentals of geodesy for geoscientists and geophysicists, surveyors and geomatics engineers, petroleum engineers, GIS specialists and spatial data analysts, project managers and planners, offshore and onshore exploration teams, pipeline and infrastructure engineers, regulatory and compliance officers, academics and researchers, new entrants to the oil and gas industry.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Dr. Steve Ehrenberg, PhD, MSc, BSc, is a **Senior Geologist & Reservoir Engineer** with **45 years** of extensive experience within the **Oil** & **Gas**, **Petrochemical** and **Refinery** industries. His wide experience covers in the areas of **Core** & **Log Integration**, **Water Saturation**, **Coring** & **Core Analysis**, **Special Core Analysis**, **Log** Interpretation, Cased-Hole Logging, **Core Calibration**, **Core Analysis**, Core-to-Log Data Integration (**SCAL**), **Wireline** Logging, **Mud** Logging, **Cased Hole** Logging, **Production** Logging, **Well Logging**, **Reservoir** Management, **Reservoir** Appraisal & Development, **Carbonate Reservoir** Management, **Fractured Reservoirs** Evaluation & Management, **Naturally Fractured Reservoir**, Integrated **Carbonate Reservoir** Characterization, **Geological Modelling**, **Reservoir Characterization**, **Geomodelling**, Development **Geology**, **Petroleum Geology**, **Exploration Production**, **Structural Geology**, **Wellsite Geology**, Analytic Modelling Methods, **Sedimentary Geology**, **Geophysics**, **Geophysical Exploration**, **Reservoir** Engineering, **Reservoir** Engineering Applications, **Reservoir** Engineering & Stimulation, **Reservoir** Characterization, **Clastic Reservoir**, **Carbonate Reservoir Petrology**, Subsurface Facies Analysis, **Borehole Images, Geophysical Methods**, **Oil & Gas Exploration**, **Marine & Petroleum Geology**, **Reservoir Performance** Using Classical Methods, **Fractured Reservoir** Evaluation & Management, **Reservoir** Surveillance & Management, **Reservoir Monitoring**, , **Reservoir Volumetrics**, **Water Drive Reservoir**, **Reservoir Evaluation**, **Well Surveillance**, **Well Testing**, **Well Testing** & Oil Well Performance, Well Log Interpretation (**WLI**), Rock Physics & Seismic Data, **Formation Evaluation**, **Well Testing** & Data Interpretation, **Pore Pressure** Prediction and **Oil & Gas Reserves Estimations**, Well Workover Supervision, Description and Prediction of **Reservoir Quality**, **Sequence Stratigraphy** of Carbonate Systems and Introductory Geology.

During his career life, Dr. Ehrenberg held significant positions and dedication as **Consultant**, **Professor**, **Senior Reservoir Geologist**, **Senior Geologist**, **Research Geologist**, **Associate Professor**, **Assistant Professor** and **Senior Instructor/Trainer** from various international companies and universities such as the Badley Ashton & Associates Ltd., Khalifa University of Science and Technology, Sultan Qaboos University, PanTerra Geoconsultants B.V, UAE University, Statoil, Stavanger, Shell Development Company and Northern Illinois University.

Dr. Ehrenberg has a **PhD**, **Master's** and **Bachelor's** degree in **Geology** from the **University of California**, **USA** and **Occidental College**, **USA**, respectively. Further, he is a **Certified Trainer/Assessor/Internal Verifier** by the **Institute of Leadership & Management** (**ILM**), a **Certified Instructor/Trainer** and has delivered numerous trainings, workshops, courses, seminars and conferences internationally.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

US$ 8,000 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Definition & Scope of Geodesy*** *Historical Development of Geodesy • Branches of Geodesy (Geometric, Physical, Satellite) • Applications of Geodesy in Science & Engineering • Importance of Geodesy in Navigation & Mapping*
0930 – 0945	*Break*
0945 – 1030	***Earth as a Geodetic Object*** *Shape of the Earth (Spheroid, Ellipsoid, Geoid) • Earth's Gravitational Field • Geodetic Reference Systems • Role of Earth's Rotation in Geodesy*
1030 – 1130	***Coordinate Systems*** *Geocentric versus Topocentric Coordinate Systems • Cartesian & Spherical Coordinates • Horizontal & Vertical Datums • Transformations Between Coordinate Systems*
1130 – 1215	***Geodetic Reference Frames*** *World Geodetic System (WGS84) • International Terrestrial Reference Frame (ITRF) • Local versus Global Reference Frames • Maintenance & Updates of Reference Frames*
1215 – 1230	*Break*
1230 – 1330	***Basic Geodetic Measurements*** *Principles of Angular Measurements • Distance Measurements (Taping, EDM) • Leveling & Height Determination • Errors & Uncertainties in Geodetic Measurements*

1330 – 1420	***Geodesy & Other Disciplines*** *Geodesy & Geophysics • Geodesy & Astronomy • Geodesy in Remote Sensing • Contributions of Geodesy to GIS*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2

0730 – 0830	***The Geoid & Its Importance*** *Definition & Properties of the Geoid • Relationship Between Geoid & Ellipsoid • Geoid Undulations • Geoid Models & their Applications*
0830 – 0930	***Gravity & Its Role in Geodesy*** *Gravity versus Gravitation • Gravity Anomalies & their Significance • Gravity Data Collection Methods • Gravity Networks & Reference Systems*
0930 – 0945	*Break*
0945 – 1100	***Earth's Gravitational Field*** *Potential Theory Basics • Equipotential Surfaces • Gravimetric Geodesy • Satellite-Derived Gravity Data*
1100 – 1215	***Height Systems & Vertical Datums*** *Orthometric versus Ellipsoidal Heights • Mean Sea Level as a Reference • Establishing Vertical Datums • Applications of Height Systems in Engineering*
1215 – 1230	*Break*
1230 – 1330	***Tides & Their Effect on Geodesy*** *Ocean Tides versus Solid Earth Tides • Tidal Corrections in Geodetic Measurements • Influence of Tides on Reference Frames • Long-Term Tidal Trends*
1330 – 1420	***Physical Geodesy Applications*** *Gravity Modeling for Resource Exploration • Oceanographic Studies Using Geodesy • Monitoring Earth's Mass Distribution • Applications in Climate Change Research*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3

0730 – 0830	***Classical Surveying Methods*** *Triangulation Principles & Networks • Traversing & its Applications • Leveling Techniques (Spirit, Trigonometric) • Limitations of Classical Methods*
0830 – 0930	***Global Navigation Satellite Systems (GNSS)*** *Principles of GNSS • GNSS constellations (GPS, GLONASS, Galileo, BeiDou) • Static versus Kinematic Positioning • GNSS Errors & Mitigation Strategies*
0930 – 0945	*Break*
0945 – 1100	***Satellite Geodesy*** *Role of Satellites in Geodesy • Satellite Altimetry for Measuring Sea Level • Satellite Gravimetry (GRACE, GOCE) • Orbit Determination & its Importance*

1100 – 1215	***Geodetic Instrumentation*** *Total Stations & their Uses • Digital levels & Barometers • GNSS Receivers & Antennas • Remote Sensing Instruments (LiDAR, SAR)*
1215 – 1230	*Break*
1230 – 1330	***Geodetic Data Processing*** *Basics of Least Squares Adjustment • Coordinate Transformation Methods • Quality Control in Geodetic Data • Software for Geodetic Computation*
1330 – 1420	***Network Design & Adjustment*** *Principles of Geodetic Network Design • Control Points & Benchmarks • Network Adjustment Techniques • Monitoring Deformation through Networks*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4

0730 – 0830	***Dynamic Earth & Geodetic Observations*** *Plate Tectonics & Crustal Deformation • Monitoring Earthquakes with Geodesy • Volcanic Activity & Geodetic Methods • Post-Glacial Rebound Effects*
0830 – 0930	***Geodetic Datums & Transformations*** *Defining & Maintaining Datums • Transforming Between Historical & Modern Datums • Regional Datums versus Global Datums • Datum Shifts & their Implications*
0930 – 0945	*Break*
0945 – 1100	***Time & Geodesy*** *Role of Precise Timing in Geodesy • Atomic Clocks in GNSS • Time Synchronization in Geodetic Networks • Time-Dependent Reference Frames*
1100 – 1215	***Geodetic Applications in Remote Sensing*** *Georeferencing Satellite Images • LiDAR in Terrain Modeling • SAR Interferometry for Surface Deformation • Applications in Land-Use Mapping*
1215 – 1230	*Break*
1230 – 1330	***Sea Level & Climate Studies*** *Measuring Sea Level Rise with Geodesy • Ocean Circulation & Geodetic Methods • Role of Geodesy in Climate Change Monitoring • Contributions of Altimetry to Climate Studies*
1330 – 1420	***Errors & Uncertainties in Geodesy*** *Sources of Geodetic Errors • Random versus Systematic Errors • Error Propagation in Geodetic Computations • Minimizing & Compensating for Uncertainties*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the T were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5

0730 – 0830	***Geodesy in Navigation & Transportation*** *GNSS in Aviation, Maritime, & Land Navigation • Autonomous Vehicle Guidance Systems • Precise Point Positioning (PPP) • Real-Time Kinematic (RTK) Applications*
0830 – 0930	***Geodetic Monitoring of Natural Hazards*** *Earthquake & Tsunami Monitoring • Flood Mapping with Geodesy • Landslide Detection & Monitoring • Early Warning Systems Using Geodesy*
0930 – 0945	*Break*
0945 – 1100	***Urban & Infrastructure Development*** *Geodesy in Construction & Engineering • Monitoring Urban Subsidence • High-Precision Surveys for Infrastructure Projects • Applications in Smart City Planning*
1100 – 1230	***Space Geodesy*** *VLBI (Very Long Baseline Interferometry) • SLR (Satellite Laser Ranging) • Doppler Orbitography & Radiopositioning (DORIS) • Contributions of Space Geodesy to Astronomy*
1230 – 1245	*Break*
1245 – 1345	***Future Trends in Geodesy*** *Advances in GNSS Technology • Integration of AI & Machine Learning in Geodesy • Enhanced Data from Upcoming Satellite Missions • Interdisciplinary Research Involving Geodesy*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

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