COURSE OVERVIEW DE0534
Gravity & Magnetics for Explorationists

Course Title
Gravity & Magnetics for Explorationists

Course Date/Venue
Session 1: April 21-25, 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
DE0534

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

Course Description

This practical and highly-interactive course includes real-life case studies 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 Gravity and Magnetics for Explorationists. It covers the fundamentals of potential field methods and the differences between gravity and magnetics in geophysics; the basic concepts of gravity and magnetic fields; the data acquisition techniques in gravity surveys and magnetic surveys; the gravity and magnetic applications in petroleum exploration; the gravity and magnetic field data processing; the basics of data filtering and enhancement; the reduction to the pole and bouguer correction; the gravity field corrections and data processing; the gravity data reduction and interpretation; the density variations and subsurface structures; and the gravity modeling and inversion techniques.

During this interactive course, participants will learn the airborne and satellite gravity methods and magnetic field corrections and processing; the magnetic susceptibility and rock magnetism; the magnetic data interpretation for petroleum exploration; the magnetic data enhancement techniques; the 3D magnetic modeling and inversion; the airborne and marine magnetic surveys; integrating gravity and magnetics with seismic data; the regional structural mapping using gravity and magnetics including salt dome and subsalt imaging; the role of AI in geophysical data interpretation and automated anomaly detection in gravity and magnetics; the basin analysis and hydrocarbon prospecting with gravity and magnetics; and the gravity data processing and magnetic data processing.

Course Objectives

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

- Apply and gain a comprehensive knowledge on gravity and magnetics
- Discuss the fundamentals of potential field methods and the differences between gravity and magnetics in geophysics
- Explain the basic concepts of gravity and magnetic fields and apply data acquisition techniques in gravity surveys and magnetic surveys
- Carryout gravity and magnetic applications in petroleum exploration as well as gravity and magnetic field data processing
- Interpret the basics of data filtering and enhancement and reduction to the pole and bouguer correction
- Illustrate gravity field corrections and data processing including gravity data reduction and interpretation
- Describe density variations and subsurface structures as well as gravity modeling and inversion techniques
- Apply airborne and satellite gravity methods and magnetic field corrections and processing
- Recognize magnetic susceptibility and rock magnetism and apply magnetic data interpretation for petroleum exploration
- Employ magnetic data enhancement techniques and illustrate 3D magnetic modeling and inversion
- Carryout airborne and marine magnetic surveys and integrate gravity and magnetics with seismic data
- Illustrate regional structural mapping using gravity and magnetics including salt dome and subsalt imaging
- Define the role of AI in geophysical data interpretation and apply automated anomaly detection in gravity and magnetics
- Apply basin analysis and hydrocarbon prospecting with gravity and magnetics
- Interpret gravity data processing and magnetic data processing

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 on gravity and magnetic for explorationists for geophysicists, exploration geologists, mining engineers, petroleum engineers, surveying professionals, environmental consultants, academic and remote sensing and geospatial analysts.

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:

Mr. Dimitri Massaras is a **Senior Petroleum Engineer** with over **35 years** of **Offshore & Onshore** experience within the **Oil**, **Gas**, **Refinery** and **Petrochemical** industries. His expertise widely covers **Petroleum Geology**, **Geophysics**, **Advanced Petrophysics**, **Petroleum Exploration**, **Petroleum Economics**, **Petroleum Engineering**, **Reservoir Modelling**, **Drilling**, **Core-to-Log Data Integration** (**SCAL**), **Basin Modelling** & **Total Petroleum System** (**TPS**), **Seismic Interpretation**, **Well Logging**, **Formation Evaluation**, **Well Testing & Data Interpretation**, **Pore Pressure Prediction** and **Oil & Gas Reserves Estimations**. He is also an expert in **Risk Analysis**, **Refining Unit** (**De-asphalting**), **Catalytic Cracking Unit** (**CCU**), **Lube Oil Unit**, **Lighter Fluid Unit**, Oil, Gas & Water Samples for **HPLC Testing and Analysis**, **Petrel**, SeisWorks, StrataModel, Finder, Charisma, Zmap, Seitex, **LogTech & GeoLog**, ASU, VSPC and many more. Currently, he is the **Senior Petroleum Consultant & Asset Manager** of one of the leading exploration company wherein his in-charge of **petroleum exploration** in various regions particularly in Algeria and Europe.

During his long career, Mr. Massaras has gained his practical and field experience through his various significant positions and dedication as the **Senior Petroleum Consultant**, **Senior Geologist**, **Project Geologist**, **Operations Geologist** and **Refinery Unit Operator** from numerous international companies such as the **Pennzoil E & P Company**, **Petrofina SA** and **Gulf Oil E & P Company** just to name a few.

Mr. Massaras has a **Bachelor** degree in **Petroleum Geology & Geophysics** from the **University of Massachusetts** in **USA**. Further, he is a **Certified Instructor/Trainer**; a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**); a former **Director** of Swiss Section of the **Society of Petroleum Engineers** (**SPE**); an active member of **Swiss Association** of **Energy Geoscientists** (**SASEG**) and has delivered innumerable trainings and workshops worldwide.

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.

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.

Accommodation

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

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	***Fundamentals of Potential Field Methods*** *Definition and Principles of Gravity and Magnetic Methods • Differences Between Gravity and Magnetics in Geophysics • Role of Potential Field Methods in Petroleum Exploration • Integration with other Geophysical Techniques*
0930 – 0945	*Break*
0945 – 1030	***Basic Concepts of Gravity & Magnetic Fields*** *Newton's Law of Gravitation and Gravitational Acceleration • Earth's Magnetic Field and Geomagnetic Variations • Relationship Between Gravity and Density • Magnetic Susceptibility and Remanent Magnetization*
1030 – 1130	***Data Acquisition Techniques in Gravity Surveys*** *Overview of Modern Gravity Meters (Land, Marine, and Airborne) • Setting Up a Gravity Survey • Data Collection Procedures and Corrections • Sources of Gravity Measurement Errors*
1130 – 1215	***Data Acquisition Techniques in Magnetic Surveys*** *Types of Magnetometers Proton Precession, Fluxgate, Optically Pumped) • Airborne, Marine, and Land-Based Magnetic Surveys • Noise Sources in Magnetic Data Acquisition • Correction Techniques for Magnetic Data*
1215 – 1230	*Break*
1230 – 1330	***Applications of Gravity & Magnetics in Petroleum Exploration*** *Regional Geological Mapping • Basin Analysis and Sedimentary Thickness Estimation • Structural Interpretation (Faults, Salt Domes, and Basement Structures) • Integrating Gravity/Magnetics with Seismic Data*
1330 – 1420	***Gravity & Magnetic Field Data Processing Overview*** *Basics of Data Filtering and Enhancement • Reduction to the Pole and Bouguer Correction • Residual vs. Regional Field Separation • Introduction to Inversion and Forward Modeling*
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	***Gravity Field Corrections & Data Processing*** *Free Air, Bouguer, and Terrain Corrections • Latitude Correction and Eötvös Correction • Tidal and Instrumental Drift Corrections • Gravity Anomaly Calculation*
0830 – 0930	***Gravity Data Reduction & Interpretation*** *Residual vs. Regional Anomalies • Mapping Gravity Anomalies for Petroleum Exploration • Identifying Fault Structures and Basin Boundaries • Interpretation Pitfalls and Ambiguity Resolution*
0930 – 0945	*Break*
0945 – 1100	***Density Variations & Subsurface Structures*** *Relationship Between Rock Density and Gravity Anomalies • Detecting Salt Domes and Sediment Thickness Variations • Gravity Response of Different Rock Formations • Differentiating Between Positive and Negative Gravity Anomalies*
1100 – 1215	***Gravity Modeling & Inversion Techniques*** *Forward vs. Inverse Modeling Concepts • Gravity Anomaly Inversion Process • Case studies of Gravity Modeling in Hydrocarbon Exploration • Software Tools Used in Gravity Modeling*
1215 – 1230	*Break*
1230 – 1330	***Airborne & Satellite Gravity Methods*** *Advantages and Limitations of Airborne Gravity Surveys • Satellite Gravity Data Applications (GRACE, GOCE Missions) • Regional Mapping with Satellite Data • Case Studies of Satellite Gravity in Petroleum Basins*
1330 – 1420	***Case Studies: Gravity Exploration in Petroleum Basins*** *Examples from Exploration Projects• Key Gravity Anomalies in known Hydrocarbon Basins • Success Stories of Gravity-Assisted Petroleum Discoveries • Lessons Learned from Failed Gravity-Based Exploration Efforts*
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	***Magnetic Field Corrections & Processing*** *Diurnal Variation and IGRF Correction • Reduction to the Pole (RTP) • Total Field Anomaly vs. Residual Magnetic Anomalies •Leveling and Filtering Techniques*
0830 – 0930	***Magnetic Susceptibility & Rock Magnetism*** *Definition and Measurement of Magnetic Susceptibility • Magnetic Properties of Common Rock Types • Induced vs. Remanent Magnetization • Identifying Key Lithologies in Magnetic Surveys*
0930 – 0945	*Break*
0945 – 1100	***Magnetic Data Interpretation for Petroleum Exploration*** *Mapping Basement Structures and Depth to Basement • Identifying Faults, Dykes, and Intrusive Bodies • Structural Mapping Using Magnetic Anomalies • Differentiating Between Sedimentary and Crystalline Rocks*
1100 – 1215	***Magnetic Data Enhancement Techniques*** *First and Second Vertical Derivatives • Analytical Signal and Tilt Derivative Methods • Spectral Analysis and Wavelength Separation • Edge Detection Methods for Structural Interpretation*

1215 – 1230	*Break*
1230 – 1330	***3D Magnetic Modeling & Inversion*** *Concepts of Forward and Inverse Magnetic Modeling • Case Studies on Magnetic Modeling in Petroleum Basins • Depth Estimation Techniques Using Magnetic Data • Integrating Magnetics with Seismic Interpretation*
1330 – 1420	***Airborne & Marine Magnetic Surveys*** *Overview of Airborne Magnetic Survey Methods • Marine Magnetic Surveys and their Applications • Combining Gravity and Magnetics in Offshore Exploration • Challenges in Processing Airborne/Marine Magnetic Data*
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	***Integrating Gravity & Magnetics with Seismic Data*** *Advantages and Limitations of Potential Field Methods vs. Seismic • Using Gravity/Magnetics for Pre-Seismic Reconnaissance • Constraining Seismic Interpretation with Gravity and Magnetics • Case Studies of Integrated Geophysical Exploration*
0830 – 0930	***Regional Structural Mapping Using Gravity & Magnetics*** *Identifying Faults and Fractures in Petroleum Basins • Recognizing Basement Depth Variations • Understanding Sedimentary Basin Structures • Case studies of Regional Mapping Applications*
0930 – 0945	*Break*
0945 – 1100	***Salt Dome & Subsalt Imaging*** *Gravity and Magnetic Responses of Salt Domes • Differentiating Between Salt and Other Low-Density Structures • Subsalt Imaging Using Potential Field Methods • Enhancing Seismic Subsalt Imaging with Gravity/Magnetics*
1100 – 1215	***Machine Learning &AI in Gravity & Magnetic Interpretation*** *Role of AI in Geophysical Data Interpretation • Automated Anomaly Detection in Gravity and Magnetics • Using Neural Networks for Predictive Modeling • Case studies of AI Applications in Exploration*
1215 – 1230	*Break*
1230 – 1330	***Basin Analysis & Hydrocarbon Prospecting with Gravity & Magnetics*** *Mapping Sedimentary Thickness Variations • Identifying Favorable Structures for Hydrocarbon Traps • Estimating Depth to Basement using Gravity/Magnetic Data • Case Studies from Exploration Projects*
1330 – 1420	***Case Studies of Integrated Exploration Using Gravity and Magnetics*** *Notable Petroleum Discoveries Aided by Gravity and Magnetics • Challenges and Lessons Learned in Real-World Applications • Comparing Success rates of Different Geophysical Techniques • Panel Discussion on Future Trends in Exploration*
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 – 0930	***Gravity Data Processing & Interpretation*** *Working with Raw Gravity Data • Applying Corrections and Filters • Identifying Key Anomalies in Real Datasets • Software Tools for Gravity Data Analysis*
0930 -0945	*Break*
0945 – 1100	***Magnetic Data Processing & Interpretation*** *Processing Airborne and Land-Based Magnetic Data • Reducing and Filtering Magnetic Anomalies • Modeling and Depth Estimation Techniques • Software Tools for Magnetic Data Interpretation*
1100 – 1230	***Advanced 3D Gravity & Magnetic Modeling Exercises*** *Building and Interpreting 3D Models • Forward and Inverse Modeling • Validating Models with Seismic and Well Data • Comparing Models with known Petroleum Accumulations*
1230 – 1245	*Break*
1245 – 1315	***Real-World Problem Solving & Data Integration*** *Case Study-based Exercises • Solving Exploration Challenges Using Gravity and Magnetics • Integrating Multiple Geophysical Datasets • Presenting Interpretation Results*
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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