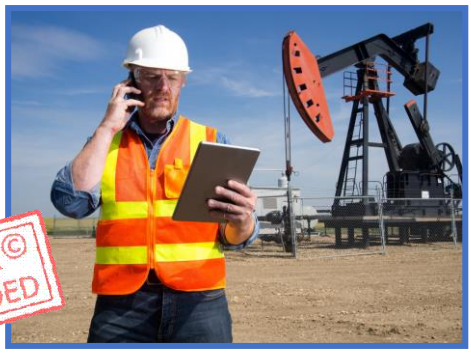
COURSE OVERVIEW DE0162-4D
Electrical Submersible Pumps

Course Title
Electrical Submersible Pumps

Course Reference
DE0162-4D

Course Duration/Credits
Four days/2.4 CEUs/24 PDHs



Course Date/Venue

Session(s)	Date	Venue
1	September 09-12, 2024	Boardroom 1, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE
2	November 25-28, 2024	Al Aziziya Hall, The Proud Hotel Al Khobar, Al Khobar, KSA

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.

Electrical Submersible Pump (ESP) is perhaps the most versatile and profitable piece of equipment in a petroleum company's arsenal. ESP is considered an effective and economical means of lifting large volume of fluids from great depths under a variety of well conditions. It has advantages over some other high-volume methods since it can create a higher drawdown on the formation and achieve more production. ESP major problems are the gas interference and the sand production. Nevertheless, the ESP companies, in conjunction with the major oil companies, have gained considerable experience in producing high viscosity fluids from gassy wells, sandy wells and high temperature wells. With this experience and improved technology, wells that were once considered non-feasible and submersibles are now being pumped economically.

This course is designed to provide participants with a detailed and up-to-date overview on the application engineering of electrical submersible pumps. It covers the ESP systems and operations, head generation, impeller types and characteristics; the components of ESP system from surface to downhole sensor including their functions, limitations and operating principles; the equipment and accessories that make up the electric submersible pumping system; the main components of the ESP and their use and functions.

Further, the course will also discuss the pump, transformers, controllers, VSD functions and benefits; the wellhead, tubing cable, cable guards, motor lead cable and intake/gas separator; the equalizer/protector, motor and instrumentation; the ESP installation considerations and cautions of standards and non-standards applications; the ESP installation procedures, reservoir formation and well considerations; the installation cautions and limitations; the design of an ESP system to fit current and future well conditions; the sizing principles for ESP artificial lift design and diagnosis; the ESP design procedure, sensitivity analysis and mechanical and electrical considerations; the steps to correctly size an electric submersible pump example problem; the impact on well and reservoir of ESP operation and the use of Nodal™ analysis in ESP applications; the effects of gas on the performance of ESP; the amount of free gas present at the pump intake; the probability of gas interference and the appropriate measures to prevent gas locking; the problems sizing equipment for gassy wells and the ESP analysis and diagnostic; the diagnostic from installed instrumentation; and using diagnostic computer programs.

During this intellective course, participants will learn the effects of viscosity on the performance of submersible pumps; the example problem in an application of a field with heavy oil properties to predict pump and motor performance; the ESP monitoring and maintenance, ESP troubleshooting, repair of failed components and ESP isolation and shutdown; the controls for ESP systems including variable speed drives; the ESP instrumentation available in the industry; the SCADA system, telemetry, PLC, ESD, VSD and troubleshooting; the ESP failure analysis, DIFA procedures, ESP inspection and failure mode; the data, record keeping and data analysis; the effects of artificial lift and ESP on project economics; the data analysis and interpretation examples; the optimization of ESP applications to improve project economics; the prediction of ESP performance under varying well and reservoir conditions; the analysis and diagnosis of real field examples from participants; and the presentations, concluding remarks from teams and the latest advances on ESP technology.

Course Objectives

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

- Apply and gain a comprehensive knowledge on electrical submersible pumps - application engineering
- Discuss the description of all components of ESP system starting at surface to the downhole sensor describing their functions, limitations and operating principles
- Explain ESP installation considerations and cautions of standards and non-standards applications
- Discuss ESP analysis and diaganostic including VSD functions and benefits
- Employ ESP monitoring and maintenance as well as ESP failure analysis and DIFA procedures
- Carryout ESP systems and operation and discuss the principles of ESP operation, head generation, impeller types and characteristics
- Identify the equipment and accessories that make up the electric submersible pumping system and the main components of the ESP including their use and function

- Recognize pump, transformers and controllers, wellhead, tubing cable and cable guards, motor lead cable and intake/gas separator, equalizer/protector, motor and instrumentation
- Carryout ESP installation procedures, reservoir formation, well considerations, installation cautions and limitations
- Illustrate the design of an ESP system to fit current and future well conditions, sizing principles for ESP artificial lift design and diagnosis and ESP design procedure and sensitivity analysis
- Identify mechanical and electrical considerations, the steps to correctly size an electric submersible pump example problem and a similar example to size an ESP
- Determine the impact on well and reservoir of ESP operation and use Nodal™ analysis in ESP applications
- Recognize the effects of gas on the performance of ESP as well as the amount of free gas present at the pump intake and the probability of gas interference
- Establish appropriate measures to prevent gas locking and solve problems sizing equipment for gassy wells
- Use diagnostic from installed instrumentation and diagnostic computer programs
- Identify the effects of viscosity on the performance of submersible pumps and example problem in an application of a field with heavy oil properties to predict pump and motor performance
- Carryout ESP troubleshooting and repair of failed components
- Apply ESP isolation and shutdown, controls for ESP systems including variable speed drives and ESP instrumentation available in the industry
- Carryout SCADA system, telemetry, PLC, ESD, VSD and troubleshooting as well as ESP inspection and failure mode
- Apply data, record keeping and data analysis and identify the effects of artificial lift and ESP on project economics, data analysis and interpretation examples
- Optimize ESP applications to improve project economics and carryout prediction of ESP performance under varying well and reservoir conditions
- Implement analysis and diagnosis of real field examples, present and conclude, remarks from teams and recognize the latest advances on ESP technology

Who Should Attend

This course provides an overview of all significant aspects and considerations of electrical submersible pumps for petroleum engineers, production engineers and field staff who are responsible for the selection, operation and maintenance of ESP.

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, sample video clips of the instructor's actual lectures & practical sessions during the course conveniently saved in a **Tablet PC**.*

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: -

- 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 **2.4 CEUs** (Continuing Education Units) or **24 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.

- 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.

Accommodation

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

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. Chris Kapetan, PhD, MSc, is a **Senior Drilling & Petroleum Engineer** with **40 years** of international experience within the **onshore** and **offshore oil** & **gas** industry. His wide experience covers Enhanced Oil Recovery (EOR), Electrical Submersible Pumps (ESP), **Cased Hole Logging** Interpretation, **Cased Hole Formation** Evaluation, **Cased Hole** Applications, **Data Acquisition** in **Cased-hole Logging**, **Drill String Design & Drilling** Optimization, **Drill String Design** Calculations, Enhanced Oil Recovery (**EOR**), Improved Oil Recovery (**IOR**), Performance Analysis, Prediction, and Optimization Using **NODAL** Analysis, **Stuck Pipe** Prevention, **Stuck Piping & Fishing** Operation, **Fishing** Operations, **Fishing** Techniques, **Fishing** Methodologies, **Wireline Fishing** Procedures, **Wireline & Coil Tubing**, **Coiled Tubing Fishing** Operation, **Coiled Tubing Technology**, **Fishing** Options in **Horizontal Wells**, **Horizontal & Multilateral Wells**, **Well Completion & Stimulation**, **Artificial Lift System Selection & Design**, **Drilling Practices**, **Drilling Fluids Technology**, **Drilling** Operations, Simulation Program for **The International Petroleum Business**, **International Oil Supply**, **Transportation**, **Refining & Trading**, **Crude** Oil Types & Specifications, Sulphur, Sour Natural Gas, **Natural Gas Sweeting**, **Petroleum Production**, Field Layout, **Production** Techniques & Control, **Surface Production** Operations, **Oil Processing**, Oil Transportation-Methods, **Flowmetering & Custody Transfer** and **Oil Refinery**. Further, he is also well-versed in **Oil Industries Orientation**, **Geophysics**, Production **Operations**, Production **Management**, Perforating **Methods & Design**, Perforating **Operations**, **Completions** & **Workover**, **Rig Sizing**, **Hole Cleaning** & **Logging**, **Well Completion**, **Servicing** and **Work-Over Operations**, Practical **Reservoir Engineering**, **Cathodic Protection** as well as Root Cause Analysis (**RCA**), Root Cause Failure Analysis (**RCFA**), **Gas Conditioning & Process Technology**, **Production Safety** and **Delusion of Asphalt**. Currently, he is the **Operations Consultant** & the **Technical Advisor** at **GEOTECH** and an independent **Drilling Operations Consultant** of various engineering services providers to the international clients as he offers his expertise in many areas of the **drilling & petroleum discipline** and is well **recognized & respected** for his process and procedural expertise as well as ongoing participation, interest and experience in continuing to promote technology to producers around the world.

Throughout his long career life, Dr. Chris has worked for many international companies and has spent several years **managing** technically **complex wellbore interventions** in both **drilling** & **servicing**. He is a **well-regarded** for his **process** and **procedural expertise**. Further, he was the **Operations Manager** at **ETP Crude Oil Pipeline Services** where he was fully responsible for optimum operations of crude oil pipeline, **workover** and **directional drilling**, **drilling rigs** and equipment, drilling of various geothermal deep wells and **exploration wells**. Dr. Chris was the **Drilling** & **Workover Manager** & **Superintendent** for **Kavala Oil** wherein he was responsible for supervision of **drilling operations** and **offshore exploration**, quality control of performance of **rigs**, **coiled tubing**, crude oil transportation via pipeline and abandonment of **well** as per the API requirements. He had occupied various key positions as the **Drilling Operations Consultant**, **Site Manager**, **Branch Manager**, **Senior Drilling** & **Workover Manager** & **Engineer** and **Drilling** & **Workover Engineer**, **Operations Consultant**, **Technical Advisor** in several petroleum companies responsible mainly on an **offshore** sour oil field (under water flood and gas lift) and a gas field. Further, Dr. Chris has been a **Professor** of the **Oil Technology College**.

Dr. Chris has **PhD** in **Reservoir Engineering** and a **Master's** degree in **Drilling & Production Engineering** from the **Petrol-Gaze Din Ploiesti University**. Further, he is a **Certified Surfaced BOP Stack Supervisor** of **IWCF**, a **Certified Instructor/Trainer**, a **Certified Trainer/Assessor/Internal Verifier** by the **Institute of Leadership & Management** (**ILM**) and has conducted **numerous short courses**, **seminars** and **workshops** and has published several technical books on **Production Logging**, **Safety Drilling Rigs** and **Oil Reservoir**.

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$ 6,750 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 course 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 – 0900	***ESP Systems Overview & Operation***
0900 – 0930	***Principles of ESP Operation, Head Generation, Impeller Types & Characteristics***
0930 – 0945	*Break*
0945 – 1015	***Components of ESP System from Surface to Downhole Sensor Describing their Functions, Limitations & Operating Principles***
1015 – 1045	***Equipment & Accessories that Make Up the Electric Submersible Pumping System***
1045 – 1115	***The Main Components of the ESP & Their Use and Function***
1115 – 1145	***Pump, Transformers & Controllers***
1145 – 1215	***VSD Functions & Benefits***
1215 – 1230	*Break*
1230 – 1300	***Wellhead, Tubing Cable & Cable Guards***
1300 – 1330	***Motor Lead Cable & Intake/Gas Separator***
1330 – 1345	***Equalizer/Protector, Motor & Instrumentation***
1345 – 1400	***ESP Installation Considerations & Cautions of Standards & Non-Standards Applications***
1400 - 1420	***ESP Installation Procedures***
1420 – 1430	***Recap***
1430	*Lunch & End of Day One*

Day 2

0730 - 0800	***Reservoir Formation & Well Considerations***
0800 – 0830	***Installation Cautions & Limitations***
0830 – 0900	***Design of an ESP System to Fit Current & Future Well Conditions***
0900 - 0930	***Sizing Principles for ESP Artificial Lift Design & Diagnosis***
0930 – 0945	*Break*
0945 – 1030	***ESP Design Procedure & Sensitivity Analysis***
1030 – 1100	***Mechanical & Electrical Considerations***
1100 – 1130	***The Steps to Correctly Size an Electric Submersible Pump Example Problem***
1130 – 1215	***Participants will use a Similar Example to Size an ESP***
1215 – 1230	*Break*
1230 – 1300	***Impact on Well and Reservoir of ESP Operation***
1300 – 1330	***Use of Nodal™ Analysis in ESP Applications***
1330 – 1400	***The Effects of Gas on the Performance of ESP***
1400 - 1420	***Amount of Free Gas Present at the Pump Intake***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Two*

Day 3

0730 – 0815	***Probability of Gas Interference***
0815 – 0845	***Appropriate Measures to Prevent Gas Locking***
0845 – 0900	***Problems Sizing Equipment for Gassy Wells***
0900 - 0930	***ESP Analysis & Diagnostic***
0930 – 0945	*Break*
0945 – 1030	***Diagnostic from Installed Instrumentation***
1030 – 1100	***Using Diagnostic Computer Programs***
1100 – 1130	***Effects of Viscosity on the Performance of Submersible Pumps***
1130 – 1200	***Example Problem in an Application of a Field with Heavy Oil Properties to Predict Pump & Motor Performance***
1200 - 1215	***ESP Monitoring & Maintenance***
1215 – 1230	*Break*
1230 – 1300	***ESP Troubleshooting***
1300 – 1330	***Repair of Failed Components***
1330 – 1400	***ESP Isolation & Shutdown***
1400 - 1420	***Controls for ESP Systems including Variable Speed Drives***
1420 – 1430	***Recap***
1430	*Lunch & End of Day Three*

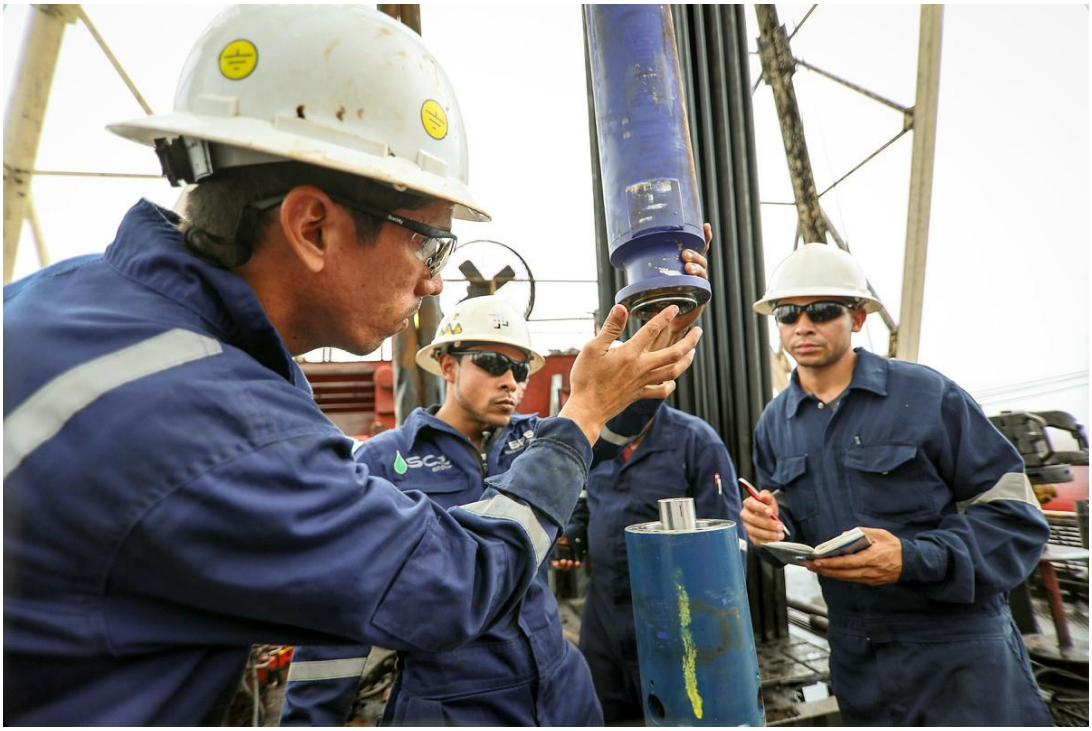
Day 4

0730 – 0800	***ESP Instrumentation Available in the Industry***
0800 – 0830	***SCADA System, Telemetry, PLC, ESD, VSD & Troubleshooting***
0830 – 0900	***ESP Failure Analysis & DIFA Procedures***
0900 - 0930	***ESP Inspection & Failure Mode***
0930 – 0945	*Break*
0945 – 1015	***Data, Record Keeping & Data Analysis***
1015 – 1045	***Effects of Artificial Lift & ESP on Project Economics***
1045 – 1115	***Data Analysis & Interpretation Examples***
1115 – 1145	***Optimization of ESP Applications to Improve Project Economics***

1145 - 1215	***Class Exercise on the Prediction of ESP Performance Under Varying Well & Reservoir Conditions***
1215 – 1230	*Break*
1230 – 1300	***Analysis & Diagnosis of Real Field Examples from Participants***
1300 – 1330	***Presentations & Concluding Remarks from Teams***
1330 – 1345	***Latest Advances on ESP Technology***
1345 – 1400	***Course Conclusion***
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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