



Electrical Submersible Pump Design and Optimization

Course Description

This course is designed to provide fundamental knowledge about the concepts that govern the selection, design, operation, construction, inspection, maintenance and optimization of Electrical Submersible Pump (ESP) systems.

This course will familiarize students with the ESP system which includes a detailed description of each ESP component as well as its deployment, design, installation, operation and surveillance requirements. The course uses a commercial software for several design conditions and applications.

During the class, ESP design exercises are planned to select the ESP pump, motor, and cable for different wellbore and reservoir conditions. At the end of the course, the participants will be able to carry out basic ESP design, understand reservoir deliverability constraints, determine and set operating parameter for installing ESP systems, and carry out performance evaluation and optimization of such systems. Operational problems related to sand production, high gas oil ratio and viscosity issues will be addressed.

The course will be supplemented by practical example problems, group exercises and interactive group discussion designed to consolidate and reinforce learning and identify solutions to specific problems associated with ESP of oil fields.

Who Should Attend?

This course is designed for petroleum engineers, production engineers, integrated study members, production Operations Engineers, assets managers, reservoir engineers, reservoir managers, facility engineers, managers, and others engineers seeking knowledge in production engineering and artificial lift methods.

What You Will Gain:

- Understand the criteria for artificial lift selection
- Understand the function of each component of the ESP system
- Learn how to model reservoir deliverability and wellbore completion constraints (IPR/VLP)



- Understand the concepts used to design and analyze of ESP systems
- Understand how ESP system can manage sand, gas, and high viscosity fluids
- Learn the processes, contemporary methods and challenges involved in the design, analysis, completion/installation, operations, monitoring and control optimization of ESP systems
- Learn the processes involved in qualifying ESP systems for life extension projects, and the methods typically implemented in life extension analysis
- Learn how to use commercial software to perform ESP designs
- Learn how to perform production optimization of ESP wells

Training Methodology

The training course will combine lectures (30%) with workshop/work presentations (30%), interactive practical exercises and case studies (20%), supported by video material, software and general discussions (20%)

Course Content

Overview of Artificial Lift Systems

- Fundamental concepts of artificial lifted wells
- Overview of artificial lift system
- Artificial lift system selection and optimization process
- Review of reservoir inflow performance modeling (IPR)
- Review of vertical lift performance modeling (VLP)

ESP Design. Review of operational aspects

- Overview of Nodal analysis
- Basic concepts related to the centrifugal pumps
- ESP basic design workflow
- Operational aspects affecting the ESP performance

ESP System components

- Subsurface components and their operational features
 - ESP pump motor
 - ESP Protector
 - ESP gas separator
 - ESP electrical cable
 - Variable Speed Drive (VSD), Variable Frequency Generator (VFG), Junction Box, wellhead completion considerations



ESP Design Workflow

- ESP design workflow
- Hands on exercise part-1, ESP design using a spreadsheet
- Hands on exercise part-2, ESP design using a commercial software

ESP Installation, Monitoring, Optimization, Troubleshooting and Diagnostic

- Overview of recommended Practice for ESP Installation
- ESP System Monitoring and Optimization
- ESP System Failures analysis
- Troubleshooting and Diagnostic
- Integrated System Modeling (ISM) concept
- ESP optimization exercise