16PL302

DRILLING TECHNOLOGY

Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	15	-	25	45	-	-	5	5

Course Description and Objectives:

The course gives an overview of drilling rig operations and related equipment; offshore drilling and advanced drilling tools; drill-string design; drill bit technology; drilling hydraulics; drilling mud design; cementation design; pore pressure and fracture pressure calculations; basic casing design; basic well control; well planning; directional drilling and well trajectory calculations. The objective of the course is to provide students with a fundamental understanding of petroleum well drilling procedures, its mechanics, and design methodology.

Course Outcomes:

The student will be able to :

- understand key aspects of drilling operations, drill rig types and fundamental differences between onshore and offshore drilling.
- explain the mechanics and design of drill bits, how different drill bits function and key issues associated with drill bit selection.
- understand the concepts and equipment required in hoisting systems, including determination of loads and hoisting power.

SKILLS:

- ✓ Describe processes associated with directional drilling and its uses in exploration and production
- ✓ An ability to apply effective, creative and innovative solutions, both independently and cooperatively, to current and future problems
- ✓ Analysis of critical safety parameters associated with drilling, such as safe drilling window, pore pressure, fracture pressure and collapse pressure.

UNIT - 1 **L- 9**

Overview of drilling: Drilling plan- GTO -Types of drilling, Rotary bit technology- Drilling string basics. Drilling fluid properties- Drilling fluid hydraulics calculations- Bit Hydraulics- Optimization- Swab & Surge-pressures- Mud hydraulics analysis report- Lost circulation. Disposing of the drilling fluids waste and drill cuttings waste.

UNIT - 2 **L- 9**

Hydrostatic pressure, Pore pressure, Causes of abnormal pore pressure, abnormal pore pressure evaluation- Mud logging methods - Measurement while drilling & logging while drilling data-Direct measurements of pore pressure - Formation integrity tests – Fracture gradient determination

– Theory of wellbore – FIT procedural Guidelines – Predicting fracture gradient HPHT well design.

UNIT – 3 **L-9, T-3**

Wellbore stability–Determination of the magnitude and direction of the in situ stress Determination of rock properties, Failure criteria – Stress distribution around a wellbore Procedure for determining safe mud weights to prevent hole collapse, Preventing borehole instability Gas behavior in a well – Kick tolerance, How to calculate kick tolerance – Influence of FG on kick tolerance – Kick tolerance while drilling – Kick tolerance graph – Modifying the calculate kick tolerance – Use of kick tolerance to calculate wellbore pressures.

UNIT – 4 **L-9, T-3**

Casing Functions of casing Types of casing Casing properties Casing specifications Casing connections Factors influencing casing design Collapse criterion Burst criterion Combination strings Tension criterion Compression loads Biaxial effects Triaxial analysis Triaxial load

UNIT – 5 **L-9, T-3**

Directional drilling: Applications- Well planning- Down-hole motors- Deflection tools and techniques- Face orientation- Direction control with rotary assemblies- Navigation drilling systems;. Horizontal wells–Well profile design considerations – Torque and drag – Horizontal borehole stability – Extended reach well design – Multilateral wells.

Stuck pipe, well control: Kicks- Kick control- Pressure control theory- BOP-Special kick problems and procedures to free the pipes and Fishing operations. Types of fishing tools, Case studies of blow out control.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours: 30

1. Study of rotary, hoisting system and power transmission system on a drilling rig.
2. To determine mud density, marsh funnel viscosity and pH of given drilling fluid sample. Sand and liquid content in drilling fluid sample.
3. Mud rheology test to determine viscosity, gel strength of yield point using Fann viscometer.
4. Circulation system, rig hydraulics and pressure loss analysis during drilling fluid circulation.
5. Fundamentals of primary well control, kick and necessary equipment.
6. Total cation exchange capacity of the drilling fluid.
7. Differentials sticking coefficient using differential sticking tester.
8. Thickening time test and study of atmospheric pressure Consistometer.