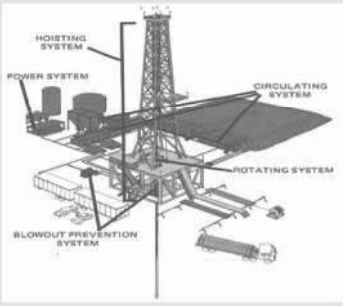
19PE213 DRILLING TECHNOLOGY



SOURCE:
http://www.oil-gasportal.com/drilling/technologies.

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
25	50	-	-	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 :

Upon completion of the course, the student will be able to active the following outcomes :

COs	Course Outcomes	POs
1	Apply and identify key aspects of drilling operations, drill rig types and fundamental differences between onshore and offshore drilling.	1,2
2	Analyze and design of drill bits, how different drill bits function and synthesis of key issues associated with drill bit selection.	3,4
3	Create a miniature model of onshore or offshore Rigs.	5
4	Apply knowledge to assess societal, health, safety and legal issues of relevant professional engineering practise of drilling engineering.	6
5	Demonstrate a knowledge and need of sustaindable development in drilling.	7

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-I **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- II **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- III **L-9**

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 in-stability; 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- IV **L-9**

DRILLING FLUID CHARACTERISTICS : Basic functions; Properties; Maintenance and treatments of drilling fluids; Drilling fluid requirement calculations; Role of formation pressure, mineralogy & petrology in designing drilling fluid; Rock texture and its relationship with drilling fluids; Design of technology specific drilling fluids for environmentally sensitive areas; Horizontal\ERD wells; HP-HT wells and depleted Reservoirs.

UNIT- V **L-9**

CEMENTS, CEMENTING & CEMENT SLURRY : Objectives of cementing; Oil well cements; Classification of cement: slurry design, slurry additives, factors influencing cement slurry design; Cementing equipment; Factors influencing cement rise behind casing and its bridging with rock and casing.

CEMENTING METHODS : Primary cementing; Stage cementing; Liner cementing; Plugging; Squeeze cementing techniques in practice; Deep well cementing; Squeeze jobs; Prevention of gas channeling; HT-HP environments; Analysis and techniques of evaluation of cement job; Characteristics of good quality cementation; Cementing calculations.

LABORATORY EXPERIMENTS

List of Experiments **TOTAL HOURS: 30**

1. Measurement of mud weight.
2. Measurement of mud density.
3. Measurement of mud plastic viscosity.
4. XRD studies of types of clay.
5. Measurement of gel strength.
6. Determination of filtration loss.
7. Determination of sand content.
8. Determination of consistency of cement slurry.
9. Determination of the setting points of the cement based slurries.

TEXT BOOKS:

1. Carl Gatlin, “Petroleum Engineering: Drilling and Well Completion”, Prentice-Hall, Inc., 1960.
2. J. J. Azar and G. Robello Samuel, “Drilling Engineering”, Pennwell Books, 2007.
3. William Lyons, “Working Guide to Drilling Equipment and Operations”, 1st edition, Gulf Publishing, 2009.

REFERENCE BOOKS:

1. H. Rabia, “Oil Well Drilling Engineering: Principles and Practice”, Graham & Trotman, 1985.
2. Neal Adams, “Drilling Engineering: A Complete Well Planning Approach”, Tommie Charrier Pennwell, 1985.
3. Steve Devereux, “Practical Well Planning and Drilling Manual”, Pennwell, 1998.
4. Robert F. Mitchell, Stefan Z. Miska, “Fundamentals of Drilling Engineering”, Society of Petroleum Engineers, 2011.