

Drilling Technology

1. Course number and name: 020TDFCS3 Drilling Technology

2. Credits and contact hours: 4 credits, 2x1:15 contact hours

3. Name of instructor: Bassam Riachi

4. Instructional Materials:

- Well Engineering and construction, Rabia H., 2001
- Drilling engineering workbook, Baker Hughes INTEQ, 1995

5. Specific course information

a. Catalog description:

A course on theoretical and practical methods of calculations and operations of drilling rigs and their systems: power systems, fluid systems, hoisting and rotary systems, control systems, drill strings and drill bits, casing and cementing systems.

b. Prerequisites: 020MEFCS2 Fluid mechanics – 020GELN14 Geology

c. Required/ Selected Elective/Open Elective: Selected Elective

6. Educational objectives for the course

a. Specific outcomes of instruction:

- Identify and explain basic types of drilling rigs and their systems
- Identify and explain drilling systems components
- Identify drilling strings, casings, bottom hole assembly components and blow out preventers
- Analyze different power systems and different mechanical transmission systems and their components on drilling rigs
- Solve problems on power generation, power requirements, and power transmission
- Apply fluid mechanics equations and theories to solve problems of drilling fluid systems
- Analyze and optimize drill bit nozzles, mud pumps and hydraulic components.
- Perform mass balance and energy balance for power systems.
- Apply and analyze basic concepts and equations for hoisting systems
- Solve problems on drill strings strength and neutral points

b. PIs addressed by the course:

PI	1.1	1.2	1.3	2.1	2.2
Covered	x	x	x	x	x
Assessed	x	x	x	x	x

7. Brief list of topics to be covered

- History of drilling from percussive to rotary and from onshore to offshore

- Types of drilling rigs and their systems: power, hoisting, mud, drill string, rotary systems; drilling activities, companies and job description and job skills, types of drilling contracts, types of drilling wells
- Introduction to fundamentals of ships and propellers systems and operations
- Overview on **Power systems** and mechanical transmission systems: Diesel engines, gas and steam turbine powerplants, electric generators and motors, gear drives, belt and chain drives, machine elements (gears, shafts, bolts, couplings, bearings ...), cooling and lubrication systems, pumps and compressors, strategies of maintenance
- Concept, design, operation and maintenance practices of **Hoisting systems**: Derrick / mast, drawworks, breaking systems, crown and travelling blocks, drilling lines, dead line anchors, supply reel
- Concept, design, operation and maintenance practices of **Fluid systems**: drilling fluid chemical and physical properties, mass balance, fluid rheology theory and models, practices on fluid tests on rigs (viscosity, density, ...), drilling fluid system components and operation, system hydraulics calculations, cut concentration and mud carrying capacity calculations, mud pumps operation and selection, nozzle theory, selection and optimization, drilling fluid treatment and cleaning system
- Concept, design, operation and maintenance practices of **Rotary systems**: system components and operation, rotary table, top drive, Kelly, drill string and BHA components and functions, drill bits types, energy requirements of drilling
- Concept, design, operation and maintenance practices of **BOP systems**: Theory of kicks, sign of kicks and measures to control kicks, blowouts and their causes, BOP components and principle of functioning, case study.
- Concept, design, operation and maintenance practices of **Drill strings and casings**: Strength analysis of drill pipes (axial and torsional loads), compressive loads and buckling of pipes, pipe deformations and neutral point determination, casing types, failures and cementing practices, formation and overburden pressure calculations
- Introduction to **Directional drilling**: Positive displacement motors and downhole turbines, components of directional drilling strings, selection of total rotational speed, introduction to LWD and MWD systems.