Design and Construction of Wells

1. **Course number and name:** 020CRPCS5 Design and Construction of Wells

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

3. **Name of instructor:** Zulfiqar Nasser Al Deen

4. **Instructional Materials**
   - "Oilwell Drilling Engineering, Principles and Practice". Dr. Hassan Rabia, First Published in 1985.
   - A Primer of Offshore Operations", Issued by Petroleum Extension Service at the University of Texas at Austin, Texas, USA.
   - Well Data Handbook by Dowell Schlumberger for drilling equipment and cementing data
   - Review of drilling rig components and basic practices, Chapter 1 of the Book "Oilwell Drilling Engineering"
   - Handouts of example primary and remedial cementing calculations
   - All the presentations used during teaching this course were made available to the students, namely those listed in the section below on Brief List of Topics Covered

5. **Specific course information**
   a. **Catalog description:** This course is the second course in oil and gas well drilling that the student takes. A basic knowledge about drilling rigs, onshore and offshore, and the drilling rig components is needed. This course focuses on the construction of a well from the beginning where the cellar is prepared, the rig is located, drilling the consecutive holes, running casing and cementing it, buildup of the wellheads, and all the processes involved within these major steps. Process such as bottom hole equipment, drilling fluids, tubular goods, directional and horizontal drilling, processes that ensure successful reaching of TD (Total Depth), and getting an idea of drilling challenges that may be encountered during the well construction process.

   b. **Prerequisites:** 020TDFCS3 Drilling Technology

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

6. **Educational objectives for the course**
   a. **Specific Outcomes of Instruction (SOI):**
   - Learn about the proper sequence and arrangement of casing strings in a well, considering factors such as well depth, formation characteristics, and wellbore stability.
   - Gain knowledge of wellhead construction, casing hangers, fixed and subsea
   - Gain an understanding of wellhead construction, including the different types of casing hangers used in both fixed and subsea environments.
   - Learn the fundamentals of casing design calculations, including determining the appropriate casing size, setting depths, and evaluating casing strength requirements.
   - Be able to perform calculations related to primary casing cementing operations, including determining the volume and properties of cement required and calculating cement plug placement.
   - Study the techniques and considerations involved in drilling deviated and horizontal wells, including wellbore stability issues and methods to mitigate them.

- Gain knowledge about drilling fluids, their properties, and their importance in controlling wellbore stability, lubrication, and cuttings removal during drilling operations.
- Learn about the hydraulic circulation system used in drilling operations, including the equipment involved and the importance of effective hole cleaning to maintain wellbore integrity.
- Understand the components of a drilling string and the design considerations for the Bottom Hole Assembly (BHA), including the selection of drill bits, stabilizers, and other tools.
- Explore different types of drill bits, their applications, and the factors to consider when selecting the appropriate bit for specific drilling conditions.

b. Performance Indicators (PI) addressed by the course:

PI	**2.1**	**2.2**	**2.3**
Covered	x	x	x
Assessed	x	x	x

7. Brief List of Topics Covered

- Introduction and Review
- Wellhead Design Onshore and Offshore
- Offshore Floating Rigs, Riser System, Motion Compensation, and Wellheads
- Drill String Design and OCTG
- Casing Design, Casing Design Review and Casing Cementing Hardware
- Primary Casing Cementing Calculations
- Remedial Cementing and Balanced Plugs Calculations
- Drilling Fluids and Solids Control
- Introduction to Directional Drilling
- Introduction to Drilling Hydraulics
- LOT (Leak Off Testing), FIT (Formation Integrity Testing), and MAASP (Maximum Allowable Annulus Applied Pressure)
- Drilling Challenges and Solutions