

Subject Code: 1ET4060402	Subject Title: Drilling Engineering
Pre-Requisite	--

RATIONALE:

The students of petroleum engineering are mainly involved in survey of land for finding petroleum under the ground with various techniques. After finding the suitable land having worth amount of petroleum data will be given to further drilling engineers for further process of drilling petroleum well. The actual petroleum production will start after drilling well and installation of the equipment for pumping the crude.

This course has been introduced at Diploma level in order to develop the skills in student so that they can understand the methods of drilling well safely with minimum cost with latest technologies.

COMPETENCY:

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire competency for oil well drilling.

COURSE OBJECTIVE:

- Demonstrate the equipment and practices of oil well drilling
- Imbibe skills to prepare a Geo-Technical order
- Illustrate the Casing practices and Cementing techniques
- Develop skills to address problems in drilling oil wells

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
3	-	2	4	60	40	20	30

DETAILS OF COURSE CONTENTS:

UNIT	TOPIC	Total Hrs.	Weightage %
1	Basic Drilling Practices Well Planning, Drilling Rig, Components, Selection and Operating systems - Hoisting, Circulation and Rotary systems, Power transmission, Rig control system. Wire lines and service life evaluation, Drilling Fluids – Basics, Functions, Classification, Properties and Nature. Drilling fluids equipment related to pressure and separation. Formulations of drilling fluid, Mud systems like Pneumatic, Synthetic oil based, Inhibitive and Non-inhibitive Rheology models of drilling fluids Mud Hydraulics and Mud weight	12	30

	and Pressure loss calculations in round trip circulation cycle Water and Oil based drilling fluid testing procedures. Latest advances and emerging trends in drilling fluid like use of NDFF. Advanced mud Technology, Balanced / Underbalanced drilling. Pore Pressure prediction, Fracture pressure, abnormal pressure. Well Planning, GeoTechnical order (GTO)		
2	Drill string, Casing and Bit Design Drill String - Components, functions and design, Casing Practices – Configuration, operation, properties, types and design, casing setting depth and hole sizes, liner design, casing handling practices Drill Bits – Types, Performance and Criteria for design.	10	25
3	Cementation Techniques Cementing, Cements & cement slurry: Objectives of cementing, oil well cements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipments. Cementing Methods -Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Deep well cementing, Characteristics of good quality cementation.	10	25
4	Drilling Problems and Remedies Pipe sticking and failure, Lost circulation, Hole Deviation, Sloughing shale, Formation damage, Bore hole instability. Drill string fatigue failure. Bit failure, wire line failure etc. Fishing and coring operations. Well kick and Blow outs: Problem, symptoms and controlling measures, Hole Cleaning. General equipment and Personnel. Safety and Environmental Impact of Drilling fluid. Waste management, classification of drilling waste, approaches of drilling waste minimization.	10	20

COURSE OUTCOME:

On completion of the course, student will be able to

- CO1 - Recognize the drilling practices on drill site
- CO2 - Express information with increased technical clarity
- CO3 - Relate changes with Change in drilling parameters
- CO4 - Investigate drilling bottlenecks during drilling
- CO5 - Plan a drilling program
- CO6 - Recommend optimum conditions to drill a well

LIST OF PRACTICAL:

1. Preparation of WBM and OBM including determination of pH of drilling fluid using pH meter.
2. To calibrate the mud balance and determine the specific gravity / density of the mud.
3. To measure the viscosity of drilling fluid using Marsh funnel viscometer.
4. To determine the Rheology of the drilling fluid using Rheometer.

5. To determine the volumes of Water, Oil and Solids in Drilling Fluid using Retort kit.
6. To determine the Fluid loss using Low-temperature/low-pressure API filtration apparatus.
7. To determine the Sand content in drilling fluid using sand content kit.
8. To determine the alkalinity in Drilling fluid and in filtrate of drilling fluid by titration method.
9. To determine the Total hardness in drilling fluid by titration method. Field procedure to determining the total hardness in mud filtrate.
10. To determine the Calcium and Magnesium in drilling fluid by titration method. Field procedure to determining the Ca in mud filtrate.
11. Field procedure for determining cation exchange capacity.
12. To determine the Emulsion stability using Emulsion stability (ES) meter.
13. To measure the gel or shear strength of drilling fluid using Shearometer.
14. To determine the Resistivity of drilling fluid and mud cake using Analog Resistivity meter.
15. Prepare homogeneous cement slurry with the help of Constant Speed Mixer.
16. To measure the absolute density of cement slurry using pressurized mud balance.
17. To determine the thickening time of cement slurries under simulated wellbore conditions using HPHT Consistometer
18. To condition cement slurry to test temperature to enable further testing using Atmospheric Consistometer.
19. To estimate the volume of filtrate lost to the formation using HPHT Filter Press.
20. To determine the rheological properties and graphical behavior of cement slurries using automated computerized viscometer.
21. To determine the stability of Cement Slurry under static Conditions using free water test.

LIST OF REFERENCES:

1. Carl Gatlin (1960), Petroleum Engineering: Drilling and Well Completion, Prentice Hall; 1st Ed.
2. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr. Richardson, TX (1991), Applied Drilling Engineering, Society of Petroleum Engineers
3. Neal J.Adams (1985), Drilling Engineering: A Complete Well Planning and approach, PennWell Books
4. H Rabia (1986), Oil Well Drilling Engineering Principles and Practices, Kluwer Law International
5. Gray and Darley (1988), Composition and properties of drilling and completion fluids, Gulf Professional publishing.
6. ASME Shale Shaker Committee (2004), Drilling fluids processing handbook, Gulf Professional publishing
7. James L. Lummus (1986), Drilling fluids optimization: a practical field approach, PennWell Books