

Roll No



**PRESIDENCY UNIVERSITY
BENGALURU**

**SCHOOL OF ENGINEERING
END TERM EXAMINATION - JUN 2023**

Semester : Semester IV - 2021

Course Code : PET3002

Course Name : Sem IV - PET3002 - Directional Drilling Technology

Program : PET

Date : 16-JUN-2023

Time : 9.30AM - 12.30PM

Max Marks : 100

Weightage : 50%

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS

(10 X 3 = 30M)

1. Identify the ODD one/ones from the following:
 - (a) ROP, WOB, Mud flow volume, Type and severity of any vibration downhole, Formation pressure [w.r.t MWD]
 - (b) Overshot, Die collar, Internal cutter, Spear [w.r.t Fishing tool]
 - (c) Mud Motor, Dump valve, String stabilizer, Drill Bit, Axial thrust bearing assembly and radial bearings [w.r.t. PDM] (CO4) [Knowledge]
2. Fill up the blank with respect to milling tools
 - (a) _____ are used to mill out collapsed pipe, restore elliptical pipe to full dia. & to remove restrictions in the well bore.
 - (b) _____ are used to mill out bottom of liners or casing which has been set with bull plug during original completion. They cut along the nose and taper.
 - (c) _____ are used to mill away metal objects that cannot be retrieved by grappling tools or junk baskets. (CO3) [Knowledge]
3. Oil industry is spending 200-500\$ million dollar annually for job related to drill pipe sticking and other hole problems. What is the name of such jobs? What is the best practice to execute such jobs? (CO3) [Knowledge]
4. Write the application of the following in Directional Drilling:(a) NMDC (b) Die Collar (c) Hole opener (CO4) [Knowledge]
5. Define Key-seat with a diagram. How to clean up a "key-seat"? (CO4) [Knowledge]
6. Match SET-1 and SET-2 [C=Rotor Lobe/Stator Lobe]
SET-1: (A) C=5/7; (B) C=9/10
SET-2: (a) Low torque (b) High RPM (c) Soft formation (d) Hard formation (e) Low power (f) High power (CO3) [Knowledge]
7. Mention the "category" of the following fishing tools: (A) Die Collar (B) Spear (C) Taper Tap (CO3) [Knowledge]

8. **“Free surface of a liquid always remains horizontal regardless of how its container is positioned”**-This is the principle of which survey tool? Why this tool is no longer used in O&G industry. (CO3) [Knowledge]
9. With the help of a diagram define Zenith Line, Azimuth and Altitude. (CO4) [Knowledge]
10. Write the limitations of PDM as a mud motor. (CO4) [Knowledge]

PART B

ANSWER ALL THE QUESTIONS

(2 X 15 = 30M)

11. **“In well planning, the key to achieving objectives successfully is to design drilling programs on the basis of anticipation of potential hole problems rather than on caution and containment”**-Briefly elaborate these potential hole problems with suitable diagrams. (CO2) [Comprehension]
12. Stuck Pipe and often consequential catastrophic Lost-In-Hole (LIH) of BHAs are increasingly present, when entering depleted oil reservoirs; and finding effective and rapid drill string recovery solutions is of imperative importance. Differential sticking is among the most costly unscheduled drilling event in the industry globally. Operators judge such costs are globally > 500 MIO USD/year; and are also the main contributor for Service Company’s drilling tools related losses. Let’s assume you are an Assistant Driller and while drilling an exploratory well, your pipe got stuck at some depth.
 (a) How will you identify it is a differential sticking?
 (b) If the pipe got stuck due to differential sticking how will identify the point of stuck? Discuss with a numerical example.
 (c) After identification of the point of struck how will you free the pipe?
 (d) What precautions you should have taken which could avoid differential sticking? (CO1) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS

(2 X 20 = 40M)

13. An exploratory directional well is drilled with Type-1 well profile near an XYZ location with slot coordinate 15.32 ft. N, 5.06 ft. E and target coordinate 1650 ft. N, 4510 ft. E. The well is kicked off at 1400 ft. depth with a BUR of 3.5 ft./100 ft. Measured depth at target is 6000 ft. Based on the given information draw the well profile with pencil and mention the length of all the important points on the wellbore trajectory. (Refer to Balance Tangential method). (CO3) [Application]
14. Two exploratory wells, Well-1 and Well-2 drilled with Type-1 well profile at some XYZ location. Both the wells drilled vertically upto depth 1300 ft. and 1500 ft. respectively. After which wellbore trajectory start to build an angle. Based on the information given make a comparative analysis of all the relevant length for the well trajectory.

Parameters	Well-1	Well-2
KOP	1300 ft.	1500 ft
BUR	2 degree/100 ft.	3.5 degree/100 ft.
MD @Target	2200 ft.	2000 ft.
TVD @End of BUS	1700 ft.	1900 ft.

(CO3) [Application]