UNIVERSITI
TEKNOLOGI
PETRONAS

FINAL EXAMINATION
MAY 2024 SEMESTER

COURSE	:	**PEB4223 - ADVANCES IN DRILLING TECHNOLOGY**
DATE	:	**5 AUGUST 2024 (MONDAY)**
TIME	:	**9:00 AM - 12:00 NOON (3 HOURS)**

INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.
2. Begin **EACH** answer on a new page in the Answer Booklet.
3. Indicate clearly answers that are cancelled, if any.
4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.
5. **DO NOT** open this Question Booklet until instructed.

Note :

i. There are **FIVE (5)** pages in this Question Booklet including the cover page .

ii. **DOUBLE-SIDED** Question Booklet.

1. Rotary Steerable Systems (RSS) enable precise, real-time control of wellbore trajectory while continuously rotating the drill string. This improves drilling efficiency, reduces non-productive time, and enhances wellbore quality, leading to cost savings and optimized production in complex formations.

    a. Explain the main types of Rotary Steerable System (RSS) and the mechanism on how to control the well direction using the RSS tool.

    [10 Marks]

    b. Design a training program for drilling engineers to maximize the benefits of using rotary steerable systems in their operations. Highlights the key components that should be included.

    [14 Marks]

2. a. There are five main disciplines under drilling engineering which are well engineering, well completion, well construction, fluids engineering and well intervention. Describe a drilling problem that is related to one of the drilling disciplines and propose a suitable drilling technology as the solution.

[10 Marks]

b. Analyze the main techniques employed in the execution of well plug and abandonment, considering both rig and rigless approaches. Furthermore, evaluate the sequential stages encompassing the plug and abandonment procedure.

[16 Marks]

3. a. The first two survey data for a deviated well are given in **TABLE Q3**.

TABLE Q3: Survey data

Survey station	Measured depth (ft)	Inclination Angle (degrees)	Azimuth (degrees)
1	1000	10	30
2	1500	15	330

i. Estimate total north, east departures, and vertical displacement from the top of the well using the Tangential method.

[10 Marks]

ii. Analyze the vertical section, given that the total north and east departures of the target are 3000 ft and 0 ft, respectively.

[4 Marks]

b. In the field of well survey calculations, various methods are employed to accurately assessing the trajectory and position of a well.

i. Analyze the limitations of the following well survey calculation methods.

- Tangential
- Average angle
- Radius of curvature

[6 Marks]

ii. Minimum of curvature method has been regarded as the industry standard in well survey. Explain your opinion on this practice.

[4 Marks]

4. Managed Pressure Drilling (MPD) is an innovative drilling technique that offers a controlled approach to wellbore pressure management during the drilling process.

   You are tasked with drilling a deepwater offshore well with the following details:

   - Well depth: 3,000 meters
   - Shallow hazard zone: 0-500 meters (shallow gas pockets)
   - High-pressure zone: 2,000-3,000 meters
   - Formation pressure gradient: 0.012 psi/ft

   Compare and justify the selection of a suitable MPD method. Consider the required pressures for each method and discuss the considerations of safety, operational efficiency, cost-effectiveness, and environmental protection.

   [26 Marks]

- END OF PAPER -