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**PRESIDENCY UNIVERSITY**

**Bengaluru**

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| **Ph.D. Course Work End Term Examinations – JAN-FEB 2025** |
| **Date:** 03 – 02- 2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** Ph.D. | |
| **Course Code:** PET800 | **Course Name:** Advanced Petroleum Well Engineering | |
| **Semester**: | **Max Marks**: 100 | **Weightage**: 50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **0** | **10** | **50** | **40** | **-------** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 10 marks. 6Q x 10M=60Marks** | | | | |
| **1** | Examine the role of rock mechanical properties and in-situ stresses in maintaining wellbore stability. Develop a numerical model to evaluate the risk of wellbore collapse in high-temperature and high-pressure (HTHP) conditions | **10 Marks** | **L2** | **CO3** |
| **2** | Analyze how thermal and mechanical loads affect casing integrity during the production phase. Identify the key factors influencing the bond strength between cement and casing and suggest methods to optimize these factors. | **10 Marks** | **L1** | **CO3** |
| **3** | Review the current industry practices for well integrity management in aging wells. Propose an integrated framework that combines real-time monitoring and predictive analytics to improve decision-making and enhance overall well integrity. | **10 Marks** | **L2** | **CO3** |
| **4** | Create a risk assessment model for planning workover operations in aging wells facing integrity issues. Discuss how machine-learning techniques can be utilized to improve the prediction of operational risks. | **10 Marks** | **L1** | **CO4** |
| **5** | Develop a decision-making framework for selecting the optimal artificial lift systems for high-water-cut wells. Explain how real-time monitoring can optimize lift efficiency and extend the operational life of the equipment. | **10 Marks** | **L3** | **CO4** |
| **6** | Investigate how automation and digitalization are transforming well design and drilling operations. Discuss how the integration of predictive analytics and machine learning can enhance decision-making, improve operational efficiency, and mitigate risks. Provide examples of technologies that illustrate these advancements. | **10 Marks** | **L2** | **CO2** |

**Part B**

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| **7.** | **Solve the following**:  I. A drillstring consists of 600 ft of 8" x 2" drill collars and the remainder is 5-inch, 19.5 lb/ft Grade X95 drillpipe. Given that the required maximum operating pressure (MOP) is 100,000 lb and the mud weight is 75 pcf (10 ppg), calculate the following:  (a) The maximum depth of the hole that can be drilled using new drillpipe.  (b) The maximum depth of the hole that can be drilled using Class 2 drillpipe with a yield strength (PI) of 394,600 lb.  II. Additionally, for a different drillstring setup: A drillstring consists of 10,000 ft of drillpipe and drill collars weighing 80,000 lb. The drillpipe has an outer diameter (OD) of 5 inches, weighs 19.5 lb/ft, and is Grade S135, premium class. Calculate the following:  (a) The actual collapse resistance of the bottom joint of drillpipe. (b) The safety factor for collapse, assuming the collapse resistance is 10,050 psi and the mud weight is 75 pcf. | **20 Marks** | **L3** | **CO3** |
| **8.** | Design a drillstring using the following data:  The outer diameter of the drillpipe is 5 inches.  Total vertical depth of the well is 12,000 feet.  Mud weight is 75 lbf/ft³ (or 10 ppg).  Total maximum operating pressure (MOP) is 100,000 lbs.  Design factor (SF) for tension = 1.3, and for collapse = 1.125.  The bottom-hole assembly (BHA) consists of 20 drill collars, each having:  Outer diameter of 6.25 inches  Inner diameter of 2.8125 inches  Weight of 83 lbf/ft  Length of 30 feet per collar.  Additionally, consider the length of slips as 12 inches.  Based on this data, you need to:   1. Calculate the total weight of the drill string, including drill collars. 2. Determine the tension load capacity based on the design factor. 3. Assess the collapse resistance based on the design factor. 4. Estimate the effective cross-sectional area of the drillpipe and drill collars to evaluate their strength and potential for buckling under pressure. | **20 Marks** | **L3** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***