Name: **Enrolment No:**	

UPES
Supplementary Examination, December 2023

Programme Name: B. Tech APE UP **Semester: III**
Course Name: Mechanics of Drilling Engineering **Time: 3 hrs**
Course Code: PEAU 2006 **Max. Marks: 100**
Instructions:

- **All questions are compulsory.**

However, internal choice has been provided. You must attempt only one of the alternatives in all such questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	If a well encounters problems during drilling and due to this problem, the approved budget fails, which two decisions should be made?	**04**	**CO1**
Q 2	Optimizing weight on bit (WOB) is an essential part of drilling to ensure that the well deepens as drilling moves forward. Justify	**04**	**CO2**
Q 3	Define Roller cone bits and major components of bit design	**04**	**CO1**
Q 4	Discuss journal angle & scrapping and gauging mechanism.	**04**	**CO1**
Q 5	Why to maintain hydrostatic pressure is greater than formation pressure? Justify	**04**	**CO2**

SECTION B
(4Qx10M= 40 Marks)

Q 6	a) Sketch the flow diagram of a "Mud Circulation System b) Explain any two properties of a drilling fluid and illustrate their importance.	**5+5**	**CO2 + CO3**

Q 7	Explain the types of drilling bits and comment on bit performance to optimize the drilling operation. **OR** Selection criteria of drilling bits and discuss the manufacturing process of PDC bit design.	**10**	**CO3**
Q 8	Distinguish the rheology control material, lost circulation material and filtration material in drilling fluid	**10**	**CO4**
Q 9	While drilling, 250 hp was applied to rotate the drillstring and bit where 500 rpm was recorded from the rotary speed machine. In addition, 175 hp was applied to rotate 3,500 ft of drillpipe off 5 in OD with the same speed as drillstring. Assume that C_d = 0.000005. Calculate the required torque for drilling string and the specific gravity of mud.	**10**	**CO4**
SECTION-C (2Qx20M=40 Marks)			
Q 10	a) The hoisting system of a rig derrick has a load of 350,000 lbf. The input power of the draw works for the rig can be a maximum of 530 hp. Eight drilling lines are strung between the crown block and traveling block. Consider there is some loss of power due to friction within the hoisting system. Compute: (1) the static tension in the fast line when upward motion is impending, (2) the mechanical advantage of the block and tackle, (3) the maximum hook horsepower available, (4) the maximum hoisting speed, (5) if a 90 ft stand is required to be pulled, what should be the required time, (6) the actual derrick load, (7) the maximum equivalent derrick load, and (8) the derrick efficiency factor b) Distinguish the conventional rigs and offshore rigs based on their applications.	**15+5**	**CO5**
Q 11	a) Calculate the liner size required for a double-acting duplex pump where rod diameter is 3.0 in, stroke length is 25 in stroke; pump speed is 75 strokes/min. In addition, the maximum available pump hydraulic horsepower is 1500 hp. For optimum hydraulics, the pump recommended delivery pressure is 3,500 psi. Assume the volumetric efficiency of pump is 98%.	**10+10**	**CO6**

	b) A diesel engine is run to generate power for the rig system. It gives an output torque rating of 1,500 ft-lbf at an engine speed of 1,170 rpm. Consider that there is a friction loss in the pulley and block and tackle system. The hook load of the rig is 580,000 lbf and there are ten drilling lines strung on the system. Find the output power of the engine, velocity of the fast line, tension of the fast line, velocity of the traveling block, power output of the block and tackle, efficiency of block and tackle. **OR** i. Derive the derrick load and derrick efficiency factor calculations with friction and without friction. ii. A 9 5/8-inch, 53.5 *lb/ft* casing string is set at a depth of 13,150 *ft*. Since this will be the heaviest casing string run, the maximum mast load must be calculated. Assuming that 10 lines run between the crown and the traveling blocks and neglecting buoyancy effects, calculate the maximum load.	**10+10**	**CO6**