Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Drilling Engineering & Well Completion **Semester: IV**
Program: B.Tech APE Gas **Time: 03 hrs.**
Course Code: PEAU2004 **Max. Marks: 100**

Instructions: *Make proper assumption for any missing data.*
Be cautious with the units and use neat and proper diagrams to assist your answers.

SECTION A

S. No.		Marks	CO
Q 1	What information are given in a well GTO?	**4**	**CO1-6**
Q 2	a) Which type of drilling fluid could be used for underbalance drilling? b) Calculate the apparent viscosity, plastic viscosity and yield point of a mud producing a torque of 24 and 36 at 300 rpm and 600 rpm, respectively, in a FANN VG Viscometer?	**4**	**CO2**
Q3	Illustrate a representative diagram of Christmas tree with well head assembly, mentioning their components, and briefly state their functions.	**4**	**CO3, CO5-6**
Q4	Determine the required orientation of the deflection tool and azimuth change, if the (new) hole inclination is to be maintained constant at 8°. Given that the current hole inclination is 7°, azimuth is N90°E and maximum dog-leg severity is 3°/100 ft. Use Ragland diagram.	**4**	**CO4**
Q5	Describe well killing procedure in wait and wait method.	**4**	**CO5**
	SECTION B		
Q6	a) Determine the number of drill collars required for a vertical well to provide a weight on bit of 55,000 lbf assuming mud density is 12 ppg, linear weight of drill collar is 192 lb/ft and average length of drill collar is 30 ft. b) Calculate the maximum depth of hole that can be drilled when using a new drill pipe (yield strength, P_t = 501,090 lb), if the required MOP is 100,000 lb and mud weight is 75 pcf (10 ppg). Drill string consists of 600 ft 8 ¼ in. x 2 13/16 in. drill collars and the rest is a 5 in, 19.5lbm/ft Grade X95 drillpipe. **or** a) Explain briefly the mud circulation system components, with neat sketch. b) Determine the volume of 11.0 ppg mud and 14.0 ppg mud required to build 300 bbl of 11.5 ppg mud?	**8**	**CO1, CO2, CO4**
Q7	Discuss briefly the design factors that affect the geometry of a tricone roller bit.	**8**	**CO2**
Q8	The following data refer to a directionally drilled well: TVD of station 1 = 1150 ft	**8**	**CO4**

	Northing coordinate of station 1 = 350 ft Easting coordinate of station 1 = 550 ft Target Bearing = 65 degree Magnetic declination = 3°west Survey data at three stations are as follows: Calculate the well path between stations 1 and 2 using the radius of curvature method, and also calculate the dog leg severity.		

Station	Measured Depth (ft)	Inclination	Actual Azimuth
1	1200	15	48
2	1400	19	58

Q9	Discuss the positive indications, causes and remedies of differential pipe stickup, lost circulation and well kick? **or** Calculate the safety factors in tension, burst and collapse under the maximum expected pressures for a 20 in. grade H-40 conductor casing designed for 26 in. hole size (to be set at 350 ft) of an exploration well. Also state whether the grade H-40 pipe is safe as conductor casing or not? *Assume that tensile load of conductor casing is not supported by next casing.* Relevant data are as follows; Drilling programme: 0-350 ft → 26 in hole 350-6200 ft → 17 ½ in. hole Mud programme: Down to 350 ft, mud weight is 65 pcf Formation fluid gradient: 0-6200 ft, G_f = 0.465 psi/ft 20 in. Grade H-40 pipe properties: nominal wt. = 94 lbm/ft, wall thickness = 0.438 in., collapse resistance = 520 psi, pipe-body yield strength = 1,077,000 lbf	**8**	**CO1-5**
Q10	a) Describe the types of well completion and their respective applications with advantages. b) Discuss briefly any four factors that affect the well perforation.	**8**	**CO6**
	SECTION-C		
Q11	The following data refer to a 1.5-inch block line with 10 lines of extra improved plough steel wire rope strung to the travelling block. Hole depth = 10,000 ft Drill pipe = 5 in. OD/4.276 in. ID, 19.5 lb/ft Drill Collars = 500ft, 8 in./2 13/16 in., 150 lb/ft Mud weight = 10 ppg Line and sheave efficiency coefficient = 0.9615 Calculate: a) Weight of drill string in air and in mud. b) Hook load, assuming weight of travelling block and hook to be 23,000 lb. c) Efficiency factor of the derrick. d) Static crown load. e) Dynamic crown load.	**20**	**CO1, CO2, CO4**

	f) Wireline design factor during drilling if breaking strength of wire is 228000 lb. g) Design factor when running 7 in. casing of 29 lb/ft. Is the design factor sufficient? **or** The following data refer to an oil well block and tackle system having 10 number of drilling lines, Maximum expected hook load = 500,000 lbf Hook load speed = 120 ft/min Hoisting drum diameter = 32 in. Mechanical efficiency of draw work = 0.88 Rating of available motors & their reasonable speed, (i) 1000 HP – 600 rpm, (ii) 2000 HP – 9000 rpm, (iii) 3000 HP – 1200 rpm Calculate: a) Efficiency factor of the derrick b) The power at the draw work in HP. c) The motor power required d) Which motor will you choose from the available options? e) The fast line speed. f) Drum speed. g) Motor to drum gear ratio when pulling out of hole the maximum allowable hook load.		
Q12	The following data are given, Casing dimensions: OD 20 in, ID 18.73 in, 133 lbm/ft Hole size: 26 in Casing setting depth: 350 ft Mud weight: 65 pcf (8.7 ppg) Cement properties: Cement API Class G with 4% bentonite Slurry weight: 106 pcf Slurry yield: 1.5ft^3/sack Water requirement: 7.6 gal/sack (Note: Cement data are obtained from cementing companies' handbooks.) Pumping rate: through casing: 300 gal/min Allow 15 min for the release of plugs and assume casing to be cemented to surface. (a) Calculate required quantities of cement and bentonite for a conventional cementing job. A shoe track of 80 ft (24 m) is to be used. Also allow 100% excess cement in the open hole. (b) Calculate volume of mixing water. (c) Calculate total time for the job, assuming that the mixing rate is 10 sacks/min. (d) Calculate the forces developed when using a conventional cementing operation and the safety factor in tension. Will the casing float? Assume pumping pressure is 500 psi and pipe body yield strength for casing is 2,012,000 lb.	**20**	**CO2, CO3, CO4**