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

Course: Principles of Analytical Chemistry **Semester: I**
Program: M. Sc (Chemistry) **Time 03 hrs.**
Course Code: CHEM 7004 **Max. Marks: 100**
No. of Pages: 2

Instructions:
1. **Attempt All questions.**
2. **Internal choices are given for question number 10 & 12.**
3. **Attempt all part of the question in continuations.**

SECTION A

S. No.		Marks	CO
Q 1	Discuss regression and regression coefficient.	4	CO1
Q 2	List out the salient features of Gaussian distribution curve with confidence limits	4	CO1
Q 3	Discuss the limitations of Lewis theory	4	CO2
Q 4	Write down the four key points regarding the advantage of complexometric titration.	4	CO4
Q 5	A sample containing 500 mg of $CaCO_3$ and 300 mg of $MgCl_2$ was dissolved in acid and made to 2000 mL. It was titrated with EDTA. What is the hardness of water?	4	CO4

SECTION B

Q 6	The phosphorus in a 0.209 gm samples was precipitated as the slightly soluble $(NH_4)_3PO_4.12MoO_3$. This precipitate was filtered, washed, and then redissolved in acid. Treatment of the resulting solution with an excess of Pb^{+2} resulted in the formation of 0.292 gm of $PbMoO_4$. Express the results of this analysis in terms of percent P_2O_5. **M.W. of $(NH_4)_3PO_4.12MoO_3$=1876, $PbMoO_4$= 367 and P_2O_5 = 142 gm/mol**	8	CO3
Q 7	List out any four uses of buffer solution in analytical chemistry	8	CO2
Q 8	Write the chemical formula for the following complex ions: **(i)** hexacyanoferrate(II) **(ii)** dichloroargentate **(iii)** disulfatocuprate(II) **(iv)** trioxaloyoferrate(III)	8	CO4
Q 9	Write a short note on fluorescent indicators, giving two examples.	8	CO3
Q 10	Describe in detail the structure of BF_3 and CO_2 molecules using Lewis theory. **OR**	8	CO2

	Discuss physiological buffers by giving appropriate examples.		
	SECTION-C		
Q 11	**a)** Find out the electrode potential for a potentiometric titration of 0.05 N Ce (IV) (60 mL) with 0.10 N Fe (III) if both solutions are made in 1M sulphuric acid. Given that $E^0{}_{Fe^{+2}/Fe^{+3}} = 0.68\ V$ and $E^0{}_{Ce^{+3}/Ce^{+4}} = 1.44\ V$ **(i)** At the start of the titration. Assume $\frac{[Ce^{+4}]}{[Ce^{+3}]} = 1000$ **(ii)** After the addition of 10 mL of Fe solution. **(iii)** At equivalent point. **(iv)** After the addition of 40 mL of Fe solution. **b)** How many moles of HCl will be required to prepare one litre of buffer solution (containing NaCN and HCN) of pH 8.5 using 0.01 g formula mass of NaCN. K_a for HCN is 4.1×10^{-10}	**10+10**	**CO3+ CO2**
Q 12	**a)** In the gravimetric analysis of aluminum as its oxide the following data were obtained. 0.5000, 0.02851, 0.02856, 0.02873, 0.02852, 0.02831, 0.02856, 0.02851, 0.02853, 0.02855 and 0.02850 Calculate mean, median, standard deviation, relative standard deviation and variance. **OR** The replicate determinations of a result gave the values of 5.34, 5.41, 5.38, 5.45 and 5.28 mg/L of a parameter. What are the confidence limits for the mean value of 95% probability level? Value of t- for 95% confidence level is 3.18 **b)** A 70.00 mL aliquot of a solution containing iron (II) and iron (III) required 12.98 mL 0.0150 M EDTA when titrated at pH 2.0 and 24.70 mL when titrated at pH 6.0. Express the concentration of each solute in ppm. **OR** Discuss the direct and back titration methods involving EDTA.	**10 +10**	**CO1+ CO4**