Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Physical Chemistry IV — **Semester:** IV
Program: BSc (H) Chemistry — **Time** : 03 hrs.
Course Code: CHEM-2006 — **Max. Marks:** 100

Instructions: Attempt all the questions.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Calculate the energy associated with (a) one photon; (b) one Einstein of radiation of wavelength 8000 A^{o}. h= 6.62 x 10^{-27} erg sec; c = 3 x 10^{10} cm sec^{-1}.	**4**	**CO1**
Q2	Calculate the electrode potential of a Ag electrode dipped in a 0.1M solution of $AgNO_3$ at 298 K, assuming $AgNO_3$ to be completely dissociated. The standard electrode potential of Ag^{+}/Ag is 0.80V at 298K.	**4**	**CO1**
Q3	The conductance of N/10 $AgNO_3$ solution taken in a cell with cell constant 0.9555 cm^{-1} is 0.0099 ohm^{-1}. Calculate (i) specific conductance; (ii) Equivalent conductance.	**4**	**CO1**
Q4	Outline briefly the advantages of using catalyst, instead of using high temperature to promote chemical reactions.	**4**	**CO1**
Q5	A substance when dissolved in water at 10^{-3} M concentration absorbs 10 percent of an incident radiation in a path of 1 cm length. What should be the concentration of the solution in order to absorb 90 percent of the same radiation.	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q 6	The standard potential of the following cell is 0.23V at 15 ^{0}C and 0.21 V at 35 ^{0}C; Pt I $H_{2(g)}$ I $HCl_{(aq)}$ I AgCl I $Ag_{(s)}$ Calculate ΔS^{0}, ΔH^{0} for the cell reaction assuming that ΔS^{0}, ΔH^{0} quantities remains unchanged in the range of 15 ^{0}C and 35 ^{0}C.	**10**	**CO2**
Q7	Discuss in details the kinetics of Reversible reactions.	**10**	**CO2**
Q8	The rate constant of a second-order reaction is 5.70 x 10^{-5} dm^3 mol^{-1} s^{-1} at 25 ^{0}C and 1.64 x 10^{-4} dm^3 mol^{-1} s^{-1} at 40 ^{0}C. Calculate the activation energy and the Arrhenius pre-exponential factor.	**10**	**CO3**
Q9	(A) Calculate the number of moles of $HCl_{(g)}$ produced by the absorption of one joule of radiant energy of wavelength 480 nm in the reaction $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$ if the quantum yield of the photochemical reaction is 1.0 x 10^{6}. (B) Describe and discuss the Jablonski diagram for depicting various photo-physical processes.	**5 + 5**	**CO3**

	SECTION-C **(2Qx20M=40 Marks)**		
Q10	(A) Calculate the hydrolysis constant and pH of 0.625 M solution of CH_3COONa. $K_a = 1.754 \times 10^{-5}$. (B) Derive Michaelis-Menten equation for Enzyme-Catalyzed Reactions ***Or*** Differentiate between (i) Specific conductance and Equivalent conductance (ii) Galvanic cell and Electrolytic cell	**10 + 10**	**CO2**
Q11	(A) What is meant by transport number of an ion? How is it determined using Hittorf's method and Moving Boundary method? ***Or*** A solution of silver nitrate containing 12.14 g of silver in 50 ml of solution was electrolyzed between platinum electrodes. After electrolysis, 50 ml of the anode solution was found to contain 11.55 g of silver, while 1.25 g of metallic silver was deposited on the cathode. Calculate the transport number of Ag^+ and NO_3^- ions. (B) The decomposition of N_2O_5 to NO_2 and O_2 is first order with a rate constant of 4.8×10^{-4} per second at 45 ^{0}C. (i) if the initial concentration is 1.65×10^{-2} mol/L, what is the concentration after 825 second? (ii) How long would it take for the concentration of N_2O_5 to decrease to 1.0×10^{-2} mol/L from its initial value, given in (i)?	**10 + 10**	**CO3**