DC442 Electrochemistry part : 12 march 2013 Home work due date: 18March 2013: Santosh Haram 10 marks

(1) State the Butler Volmer Formulation for the charge transfer electrode reaction O+e↔ R Show that the equation gets simplify to Nernst equation up on imposing the equilibrium condition.

(2) Calculate the net current density for the varied over potential ranging from +500mV to -500mV with a step of 50mV, for the exchange current densities j_o = (a) 10^{-3}A cm^{-2} (b) 10^{-6} A cm^{-2} and (c) 10^{-9}A cm^{-2} , for the reactions of the type O+e↔ R assume α=0.5 and T=298K.

(3) Calculate the net current density for the varied over potential ranging from +500mV to -500mV with a step of 50mV, for the exchange current densities $j_o = 10^{-3}$A cm^{-2} for varied α (a)=0.75 (b) 0.50 and (c) 0.25, at temperature 298K

(4) In the well stirred electrochemical cell the anodic current was found to be 1% of the cathodic current , what over potential should apply to the system, so that system will reach mass transport ,limit ?

(5) Consider each of the following electrode-solution interfaces write the equation of the electrode reaction that occurs first when potential is moved in (i) a negative direction (ii) positive direction, from the open circuit potentials.

a. $Pt/Cu^{2+}(0.01M), Cd^{2+}(0.01M), H_2SO_4(1M)$

b. $Pt/Sn^{2+}(0.01M), Sn^{4+}(0.01M), HCl(1M)$

c. $Pt/Cd^{2+}(0.01M), Zn^{2+}(0.01M), HCl(1M)$

(6) Consider the electrode reaction, O+e↔ R under the conditions that $C_R^* = C_O^* = 1mM$, $k^o=10^{-7}$cms^{-1}, α=0.3 and n=1

a. Calculate the exchange current density j_o

b. Draw the current density=overpotential curve for this reaction for current density upto 600μA cm^{-2} anodic and cathodic. Neglect the mass transfer effect.

(7) The following data were obtained for the reduction of species R to R^-in stirred solution at 0.1cm^2 electrode. The solution at 0.1 cm^2electrode. The solution contains 0.01M R and R^-

η(mV)	-100	-120	-150	-500	-600
I(μA)	45.9	62.6	100	965	965

Calculate i_o, k_o, α, R_{ct} , and i_L,