Homework No 4

E15.6. For the cathodic protection of a steel pipeline, the following information has been obtained from the potential survey shown in Table E15.1.

Table E15.1 PS Data for the Cathodic Protection of a Steel Pipeline

Parameter	Drain Point 1
Drainage current measured, I_{om} (A)	16.6
Potential increase measured at the end of the section, ΔE_L (V)	0.26
Attenuation coefficient, α (km^{-1})	0.5
Protected pipe length, L (km)	3.86
Measured potential increase at the drainage point, ΔE_{om} (V)	0.83
Drainage current coefficient, k_i	1.5
Resistance of lead wire, ρ_w (Ω mm^2 m^{-1})	0.0015
Resistance of backfill, ρ_a (Ω mm^2 m^{-1})	0.0052
Resistance of soil, ρ_s (Ω mm^2 m^{-1})	0.096
Length of lead wire, l_w (m)	375
Length of the anode, l_a (m)	1.1
Length of the anode with coke breeze backfill, l (m)	4.82
Depth of the anode ground bed, t (m)	2
Wire cross section, a (mm^2)	15.5
Radius of the backfill, d_{bf} (m)	1.25
Radius of the anode, d_a (m)	0.28
Weight of a single anode of Fe-Si, W_a (kg)	68
Anode wear rate, R (kg/A year)	0.07
Accepted current per anode, I_a (A)	5.0

(a) Calculate the following parameters:
1. Potential at the drainage point. Compare it with the measured value
2. Resistance of the pipe
3. Current at drainage point
4. Anode resistance
5. Number of anodes in the ground–bed
6. Resistance of the anode ground–bed
7. Lead wire resistance
8. Rectifier power needed
9. The anode wear and cycling life of the system.