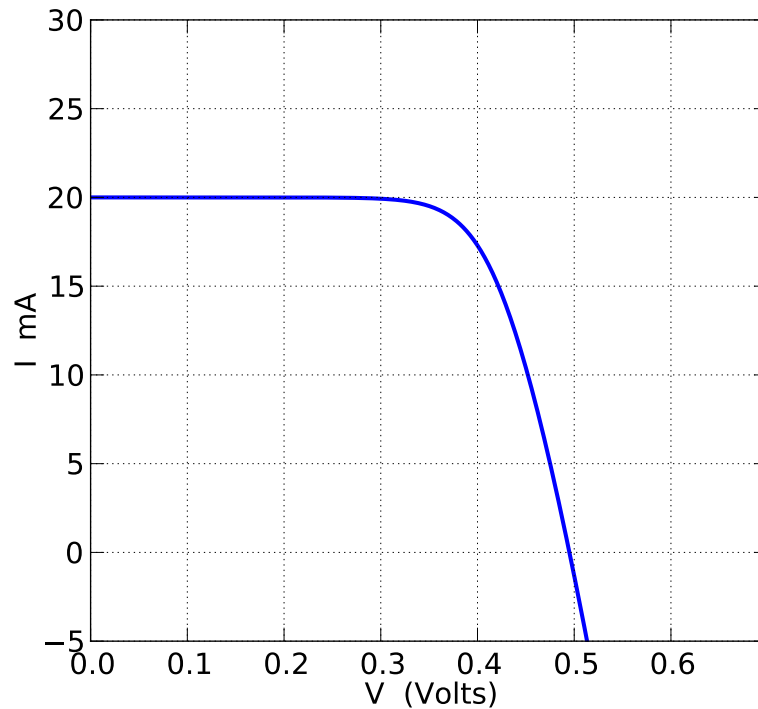


1. (2.5 pts) The IV characteristic of a photovoltaic cell is shown.
 - a) Estimate the fill factor and the series resistance.
 - b) Derive an analytical expression for the series resistance. Obtain a nearly exact value for the series resistance within this analysis.



2. (1.5 pts) A p-n junction solar cell has $V_{oc} = 0.6$ V and $J_{sc} = 30$ mA/cm². A second cell, of the same area, has $V_{oc} = 0.7$ V and $J_{sc} = 12$ mA/cm². Assume that both cells obey the ideal diode equation,
 - a) Find the values of V_{oc} and J_{sc} when the two are connected in parallel?
 - b) Find the values of V_{oc} and J_{sc} when the two are connected in series?

q	1.6×10^{-19} C	electron charge
ϵ_0	8.85×10^{-14} F/cm	permittivity of free space
K_s	11.8 (Si)	relative dielectric constant
K_o	3.9 (SiO ₂)	relative dielectric constant
k_B	8.617×10^{-5} eV/K	Boltzman's constant
h	6.63×10^{-34} J s	Planck constant
m_o	9.11×10^{-31} kg	electron mass
$k_B T/q$	0.0259 V at 300 K	thermal voltage
c	3×10^8 m/s	speed of light