Physics 333 **Electromagnetic Theory I** **Fall 2022**

Homework Assignment #17

(Note: both Homework #17 and Homework #16 are due Oct. 5)

1. Griffiths 3.21 Hint: To map the problem to the solution of Example 3.8 of the text book, choose $V = 0$ to be in the plane $\theta = \frac{\pi}{2}$ (and at infinity).

2. Griffiths 3.24
   Hint: To find the solutions for $S(s)$ and $\Phi(\phi)$ distinguish the cases of $k^2 > 0$ (the constant of the separated variables) and $k^2 = 0$ (which in this case is also a solution). Also use that Φ needs to be periodic with period 2π. If you are completely stuck see hint to problem 3.25, but try to derive this expression for $V(s, \phi)$.

3. Griffiths 3.25
   Hint: Use the result of problem 3.24, that is that

$$V(s,\phi) = a_0 + b_0 \ln s + \sum_{k=1}^{\infty} s^k (a_k \cos(k\phi) + b_k \sin(k\phi)) + \sum_{k=1}^{\infty} s^{-k} (c_k \cos(k\phi) + d_k \sin(k\phi))$$

   Also, choose $V(s = R) = 0$. (We have the choise where to pick $V = 0$. We know that on the conductor surface V is constant, so for simplicity let's choose this constant to be zero.)

   And choose the uniform electric field to be in the $\hat{\mathbf{x}}$ direction. This choice allows you to determine by direct comparison coefficients of a polynomial of $\cos\theta$.